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SUBJECTS AND POLICY AREAS FOR THE CONSIDERATION OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

98th Congress

REPORT

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LETTER OF TRANSMITTAL

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C. 20515.

To the Members of the Committee on Science and Technology:

The Legislative Reorganization Act of 1970 charged the Congressional Research Service of the Library of Congress with providing Congressional Committees, at the beginning of each Congress, a "list of subjects and policy areas the committee might profitably analyze in depth." I am transmitting herewith the report "Subjects and Policy Areas for the Consideration of the House Committee on Science and Technology, 98th Congress."

This report is the seventh of its kind prepared for the committee, and is in part based on extensive interviews conducted by the CRS with the committee staff and Members' staffs.

I believe the committee will find this report a useful resource as it proceeds with its legislative and oversight activities during the 98th Congress. Moreover, the report identifies a number of emerging issues which are likely to command attention as the committee emphasizes its foresight and futures research responsibilities.

Sincerely,

DON FUQUA, *Chairman.*

LETTER OF SUBMITTAL

CONGRESSIONAL RESEARCH SERVICE,
THE LIBRARY OF CONGRESS,
December 27, 1982.

Hon. DON FUQUA,
Chairman, Committee on Science and Technology,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: As you know, the Legislative Reorganization Act of 1970 requires the Congressional Research Service to make available to each committee, at the beginning of each Congress, "a list of subjects and policy areas the committee might profitably analyze in depth."

The report on the Act declared that the list is intended to assist committees and the Service in planning their respective research schedules for the forthcoming Congress, and it instructed the Service "to work closely with committee staffs in the preparation of that list."

As a result of discussions between Dr. Gail H. Marcus and other CRS staff and Mr. Robert C. Ketcham and other members of the committee staff, a list of subjects suggested for analysis is transmitted herewith, which we hope will be of practical value to the committee and reflect its interests during the 98th Congress.

It is understood, of course, that the inclusion of any particular subject on your list does not represent a judgment on the part of CRS that your committee has either prior or exclusive jurisdiction over that subject.

It is my sincere hope that this list will be useful to the committee. So far as our resources permit, we will be happy to respond to any requests for initial or further analysis of subjects on the list, or other subjects as they arise, or for any other suitable assistance.

Sincerely,

GILBERT GUDE, *Director.*

Congressional Research Service
The Library of Congress

Washington, D.C. 20540

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REPORT FOR THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY ON THE SUBJECTS AND POLICY AREAS WHICH THE COMMITTEE MIGHT WISH TO ANALYZE IN DEPTH DURING THE 98TH CONGRESS

Submitted in Accordance with Section 321(a)
Legislative Reorganization Act of 1970

Prepared by the
Congressional Research Service
Library of Congress
December 27, 1982

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This compilation of Subjects and Policy Areas for the House Committee on Science and Technology for the 96th Congress was coordinated by Dr. Gail H. Marcus, Assistant Chief of the Science Policy Research Division (SPRD). Divisional review of the final product was provided by Dr. Marcus and Dr. James M. McCullough. A number of CRS analysts and specialists contributed their efforts to suggesting and developing appropriate Subjects and Policy Areas for the Committee. These persons are listed below and their efforts are gratefully acknowledged.

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I. GENERAL FEDERAL SCIENCE AND TECHNOLOGY POLICY

OVERSIGHT OF THE REAGAN ADMINISTRATION'S SCIENCE POLICY

Issue

In contrast to other areas of discretionary funding which have sustained large decreases under the Reagan Administration's budget, science and technology funding, in the aggregate, has remained relatively unscathed. However, several fundamental shifts in science policy and research funding have occurred, stemming from the Administration's views that economic recovery is the Nation's most important priority and that national economic revival will benefit science more than exemptions from budget-cutting. The Administration also has called for increases in R and D funding for defense. Criticisms of these policies have been made by some scientists and politicians.

Background

The Administration's priorities and funding for research and development are based on a philosophical orientation embodying four points: (1) the preeminence of economic recovery, (2) the use of the private sector, (3) strengthening of the Nation's military posture, and (4) decreasing the Federal role in favor of the States, that is, the "New Federalism."

Analysis

Some scientists and some Members of Congress have criticized the Administration's science policies for the following reasons: they say that cutbacks in civilian R and D funding and the increases in defense R and D funding will further erode the state of U.S. science and technology. Some report that the cutback in funding will produce a lack of continuity which will erode the infrastructure of science and technology. The Administation's fiscal year 1982 and 1983 budgets attempted to cut back or realign the funding and functions of many Federal laboratories for reasons of fiscal austerity and alleged inefficiency and inappropriateness of the Federal Government's engaging in some kinds of research best left to the private sector. A major issue is: by this move, will the Administration inadvertently force an irreparable loss of accumulated expertise and the benefits of established patterns of interdisciplinary team research? Objections have been heard about funding cuts that have been made to science education programs. These were cut on the grounds that: (1) States and localities should have firstline responsibility for precollege science education, (2) the NSF programs were ineffective, and (3) there is sufficient public and private funding for training of scientists and engineers at graduate levels. Federal funding for universities has been cut back, and industry has begun to support substantial amounts of university research. A major issue is whether adequate mechanisms can be devised to promote industry-university cooperation while avoiding threats to the integrity of traditions of intellectual freedom. A related issue is whether the Federal Government should take steps to increase the incentives for industry to support more in-house research, especially basic research, and more university research. Another issue is whether the President's Office of Science and Technology Policy should broaden its work, from a purported orientation to physics and military technology, to focus more on some of the critical issues affecting the Nation's science and technology policy, including those listed above.

THE REAGAN ADMINISTRATION'S POLICIES FOR BASIC RESEARCH: ARE THEY SOUND?

Issue

Is the United States Government devoting sufficient attention to funding the appropriate mixture of civilian and defense basic research to enable the United States to maintain its high-quality science base?

Background

According to the American Association of the Advancement of Science in its spring 1982 analysis of the FY83 budget, federally funded basic research will increase about 14.9 percent, in terms of current dollars, during the period FY 1981 to FY 1983, but, according to the American Association for the Advancement of Science, will decline 1.3 percent in terms of constant 1972 dollars. Only three agencies are budgeted to receive constant dollar increases for basic research in FY 1983, in comparison with FY 1981: DOD, NASA (high-energy physics), and Commerce (all in the National Bureau of Standards).

Analysis

One major issue is: will U.S. science be harmed by increases in Federal support for defense basic research and cutbacks in support for civilian basic research? Some contend that military-oriented basic research does not generate the broad scope of knowledge produced by civilian basic research and that, as a result, there will be a significant cutback in the stock of scientific knowledge and manpower potentially available for developing high-technology commercial products, much to the detriment of this Nation's trade future. Others contend that investments in military R and D generate considerable knowledge and technological breakthroughs that "spin-off" to the civilian sector.

Another problem is that instability and lack of continuity in funding may erode the infrastructure of science and technology. A Washington Post editorial of February 3, 1982, dealt with this topic:

> Ways should also be explored to assure more continuity in the amount of support . . . research is given. It takes nine years to produce a Ph.D. scientist, and years to assemble a research team and carry a project to fruition. When the money disappears for a few years the people disappear too, and can seldom be brought back. Abrupt changes like those that took place during last year's budget cycle can therefore wipe out years of past investment and future productivity.

Others say that cutbacks in civlian R and D erode the infrastructure of science and therefore are a threat to national security. At the 1981 National Academy of Sciences Conference on the R and D budget, it was contended that the cuts in civilian R and D might force the United States to lose leadership to its international competitors, especially in high-energy physics and astronomy. The cuts, it was alleged, would lead to a conservatism in funding long-term research projects; new programs would not be started; instrumentation would not be updated; graduate students would not be able to obtain support; and some Federal laboratories might be dismantled.

STABILITY AND CONTINUITY FOR LONG-TERM R&D: MULTIYEAR AUTHORIZATION

Issue

Most federally funded research and development programs are authorized on an annual basis. However, a longer range approach may be more appropriate for many R&D programs.

Background

In the 96th Congress, hearings were held on the subject of multiple year funding of research and development programs. While it has not been demonstrated conclusively that multiple year funding would contribute to a more efficient and effective administration of major R&D programs, it is reasoned that such funding could, among other things, provide the continuity required for Federal program administrators and bench scientists and engineers to plan and carry out their long-range R&D programs more effectively. While no hearings were held on this subject in the 97th Congress, it is possible that Congress may continue its evaluation of this type of funding for major R&D programs during the 98th Congress.

Lengthening the authorization's cycle also could provide congressional committees with more time to evaluate individual science and technology programs more closely. By decreasing the number of programs that would have to be dealt with each year, it might be possible to improve the depth of programmatic and budgetary review. However there are additional factors to be considered. In particular, the deleterious effects of inflation may be exacerbated by a practice that would increase the amount of time that would elapse between the time when initial budgetary estimates are drafted and the time when the funds actually are spent. Also some feel it might decrease the opportunity for congressional control of Federal programs.

Analysis

Adoption of multiyear authorization procedures could alleviate the workloads of congressional committees that now devote more than 75 percent of their time to annual authorization reviews, as well as improving the quality of performed oversight functions and better serving the needs of scientific research. Substantively, the issue is important because of its potential for improving continuity for financing research and development programs while, legislatively, it is important because of its potential for allowing more effective use of committee time. This issue could be resolved within the next two or three Congresses.

The magnitude of the effects that inflation could exert on a multiyear authorizations process should be determined. Congress may wish to continue to experiment with multiyear authorization practices on a limited basis. Thereafter, Congress may wish to explore extending the time frame for the entire budgetary process, not just the authorization process, to a biennial or multiyear basis.

OVERSIGHT OF THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY

Issue

Should the Office of Science and Technology Policy broaden its coverage to include more management of issues relating to the infrastruture and resources for science and to issues relating to the use of science to solve social problems?

Background

The Office of Science and Technology Policy (OSTP) was created pursuant to P.L. 94-282, the National Science and Technology Policy, Organization, and Priorities Act of 1976. OSTP provides scientific and technological analyses and information to the President and works with OMB. The Director of the OSTP is the President's science and technology advisor. The Director also serves as the Chairman of the Federal Coordinating Council for Science, Engineering, and Technology, and as Chairman of the Intergovernmental Science, Engineering, and Technology Advisory Panel. The Office is divided into sections dealing with Energy and Natural Resources, International Affairs, General Science, Life Science and Institutional Relations, and National Security and Space. The current OSTP differs in an important respect from its immediate predecessor since it is aided by a White House Science Council, composed of 15 scientists, overwhelmingly physicists, which created five panels to deal with specific subject areas. The panels deal with: the national airspace system, Federal laboratories, future military technologies, special nuclear materials, and acid rain peer review.

Analysis

Questions have been raised about the Director's expertise and management and relative inexperience in dealing with national science policy issues. In addition, some critics believe that the OSTP does not interface appropriately with Federal agencies that support R and D, and that it should broaden its work to focus also on such areas critical to the goverance and use of science as instrumentation, university research, the balance between civilian and defense basic research, the practical applications of science and technology, developing an internationally competitive space policy, strategic materials, better preventive medicine and health care, a coherent agricultural research policy, an improved nuclear policy, telecommunications policy, and transportation policy. Legislation was introduced in the 97th Congress to reinforce the responsibilities of the OSTP in some of these areas.

Attention also seems warranted to the issue of whether the OSTP should reassume direct responsibility for preparing the annual and five-year science policy reports mandated by P.L. 94-282. A broader issue is whether the OSTP has carried out the functions mandated by P.L. 94-282.

IMPROVEMENTS NEEDED IN FEDERAL SCIENCE POLICY REPORTS

Issue

There is considerable criticism that statutorily required science policy reports are too long and off target and that they do not meet the requirements of their legislative mandates. Suggestions have been made to combine the several reporting requirements into a single report.

Background

The National Science and Technology Policy, Organization, and Priorities Act of 1976, P.L. 94-282, requires that the President's Science Advisor prepare an annual report on science and technology and an annual five-year outlook. The annual report is to summarize the work of the Office of Science and Technology Policy (OSTP), and needs of national science and technology policy. The five-year report is to address problems and opportunities requiring the national use of science and technology. The weakening of the reports requirement resulted shortly after the legislation was enacted, when the President, by Executive Order, transferred the report preparation function from the OSTP to the National Science Foundation (NSF). NSF has since delegated responsibility for part of the reports preparation to the National Academy of Sciences and to groups of scientists, who meet for a few days or separately write papers. The Congress requires the National Science Board (NSB), the governing body of the National Science Foundation, to write an annual report dealing, in the main, with science policy issues relevant to the National Science Foundation. Part of the NSB response has consisted of the well-received series Science Indicators. Most of the other substantive annual NSB reports have not been as well received and do not seem to have made much of an impact on science policy decisions.

Analysis

Various science policy forums have addressed the issue of the quality of the mandated reports. The consensus of these is that the reports are too academically oriented, too long, do not serve the policy objectives outlined, and are not useful to Congress. Members of the National Science Board have, from time to time, requested a legislative change mandating the Science Indicators report every three years, but, at the same time, enabling NSB to report on other issues only when necessary. Suggestions have been made, and legislation has been introduced, to combine the several reporting requirements into one presidentially enunicated report or to allow the NSB to report as it requires. Attention might be directed to these issues in order to provide more cost-effective and efficient reports.

FEDERAL LABORATORIES

Issue

Are the Federal laboratories being adequately funded, managed, and integrated into overall Federal science policy?

Background

There are about 800 Federal laboratories. About one-third of the Federal R&D budget is allocated to these laboratories. They range from small mission-oriented laboratories in the smaller departments and agencies to the large, multipurpose laboratories of the Department of Energy (DOE), such as Argonne National Laboratory and Brookhaven National Laboratory. The latter laboratories, as their names indicate, are included in what are termed "national laboratories." National laboratories are an imprecisely defined group of major Federal laboratories which include the National Bureau of Standards of the Department of Commerce, the National Center for Atmospheric Research supported by the National Science Foundation, and others in addition to the DOE multipurpose laboratories. Most Federal laboratories are staffed by Federal employees. Some, however, like the DOE multipurpose laboratories, are Government owned but are operated by contractors, including corporations and university consortia. Many Federal laboratories are considered to be a national resource of inestimable value. Others may have outlived their usefulness or purpose, decreased over time in scientific effectiveness, be poorly managed, be suffering budgetary and budget-related staffing problems, or be poorly integrated into overall department or agency missions and/or national science policy. This may become particularly true if the Department of Defense R&D budgets continue to increase disproportionately to the R&D budgets of the civilian R&D departments and agencies.

Analysis

The Director of the Office of Science and Technology Policy in the Executive Office of the President has directed the White House Science Council to review the Federal laboratories with three objectives in mind: "to define appropriate roles and missions for Federal laboratories today, bearing in mind their agencies' missions, and the capabilities of major research universities and of industry; to identify systemic impediments to satisfactory performance by Federal laboratories, and make recommendations for removing them; and to identify the unique strengths of the Federal laboratories, citing specific examples of centers of excellence where possible." Likewise, the September 1982 Final Report of the Multiprogram Laboratory Panel of DOE's Energy Research Advisory Board found that there "is a greater need for stability and continuity in policy and purpose in managing and funding the Laboratories. This need arises from a decade of major shifts, the result of both congressional actions and shifts in Administration policies. Obviously such changes are fundamental to our system of government and are not likely to be avoided. Some of the major impacts on the multiprogram national laboratories might have been reduced if there had been a single, stable, top-level

office concerned only with the laboratories as long-term assets, physical and personnel. The present situation is in part the result of overfragmentation of the long-term programmatic decision process."

Although the latter statement refers only to DOE's large multiprogram laboratories, it may be suggestive of problems endemic to Federal laboratories as a whole. With reports such as these recently completed and on-going, it may be appropriate for Congress in its oversight function to look at the Federal laboratories as a whole to determine how effectively each is doing its job and how effectively each relates to overall national science policy.

IMPLICATIONS OF CUTBACKS IN CIVILIAN R AND D

Issue

One of the criticisms made most frequently of the Administration's R and D policies is that science and technology policies should be accorded the same support and attention as policies for national security, tax cuts, and other elements of the Administration's strategies for economic recovery, and that the emphasis on defense R and D runs contrary to this goal. The argument is made that cutbacks in civilian R and D funding and increases in defense R and D funding will further erode the infrastructure and productive capacity of U.S. science and technology.

Background

An important element of the Administration's R and D philosophy is that the national defense should be strengthened by increasing funding for military research and for defense-oriented basic research. In its spring 1982 analysis of the FY83 budget the American Association for the Advancement of Science (AAAS) estimated that, in terms of constant 1972 dollars, defense basic research will increase 16.9 percent between the fiscal years 1981 and 1983, that non-defense basic research will decline 3.8 percent, and that applied defense research will increase 5.3 percent and that non-defense basic research will decline 20.2 percent. Comparative statistics show that, although the United States spends more in the aggregate on R and D than its major economic competitors combined (Japan, West Germany, and France), the major U.S. increase in the past few years has been for military, not for civilian R and D. As another measure, although the U.S. balance of trade in R and D intensive products are increasing in absolute terms, they are losing market share in comparison with other countries. Japan invests only about 2 percent of its govennmental R and D budget on security and defense-related R and D, while West Germany invests only about 12 percent. The United States invests about 50 percent of its Federal R and D budget in security and defense R and D.

Analysis

According to some critics, most of the increases in military research funding will go for weapons research. They contend that weapons research, as well as other defense research, probably does not generate as many economic benefits as civilian R and D because knowledge generated in weapons research does not transfer to the civilian sector and that most defense research is short-term, not long-range. In addition, it is contended that companies that receive massive funds for defense research draw off engineering and science faculty because of the attraction of higher salaries, further weakening the capability of American schools to produce more science and engineering graduates. Others disagree, and contend that military R and D has generated "spin-off" technology important to the civilian economy--citing in particular integrated circuits and most aircraft technology. Attention seems needed to oversee the possible positive and negative impacts of increasing support for military R and D and cutbacks of civilian R and D.

OVERSIGHT OF SUPPORT FOR ENGINEERING AND APPLIED SCIENCE IN THE NATIONAL SCIENCE FOUNDATION

Issue

The Congress has not undertaken intensive oversight of the engineering and applied science support program in the National Science Foundation (NSF). Allegations have been made of de facto elimination of applied science support programs in NSF since the reorganization, in 1980, which created the Directorate for Engineering. Because U.S. engineering science seems to have fallen behind foreign engineering in some technical areas, special attention also seems needed to determine the objectives and outcomes of the NSF engineering support program.

Background

The NSF Directorate for Applied Science and Research Applications was established in 1978 to improve the NSF's management of its science applications activities. Two years later, NSF abolished this directorate and replaced it with the Directorate for Engineering. The Foundation appears to have created the new directorate, in part, to thwart proposals to create a separate engineering foundation or a National Technology Foundation, which was endorsed by the engineering communities. Applied science was no longer to be funded as a separate item or in a separate directorate, but, instead, the applied sciences were to be funded by each separate NSF directorate.

Analysis

This is a timely issue for congressional consideration since the Foundation has had over two years with which to commence and evaluate the work of the new directorate. The objectives and achievements of the NSF engineering support programs seem to warrant evaluation in the broader context of the Nation's engineering needs and the question of whether or not the Foundation's programs meet the objectives expressed by engineers who sought a separate foundation to support engineering sciences and student support in this country.

Another issue is the allegation that since applied science support programs are no longer a separately recognizable activity, but are to be funded by each separate division, proposals for applied science generally do not compete successfully since NSF prefers to fund basic research, its original mission. Charges have been made that many university professors of applied science feel uncomfortable applying to NSF, an agency they characterize as an aloof and elite bureaucracy. If true, these trends would be directly contrary to the 1968 legislation which gave NSF an explicit mandate to support applied science.

ALTERNATIVE WAYS TO FUND R AND D

Issue

As the Federal Government begins to cut back on funding for civilian R and D, should it use mechanisms other than the traditional project grant system to fund research? Are there funding sources alternative to the existing public and private methods?

Background

Budget constraints and deliberate policy choices have forced cutbacks in civilian research, civilian basic research, and Federal funding for research in universities. Cutbacks also have forced constraints in some scientific training programs in the biomedical area. At the same time university researchers and administrators continue to complain about the time and effort that is required to fill out the Federal paperwork forms accounting for receipt of Federal funds.

Analysis

There may be several alternatives to traditional project grant awards for scientific research, which may both aid in producing more cost effective research and in avoiding some of the time and effort reporting required now by traditional research support mechanisms. These would include, for instance, the "star-proposal," which is the award of one large project grant to a well-known, research-productive scientist, who would be given the responsibility of distributing part of the funds to other potentially research-productive scientists. The one scientist would be responsible for accounting and distributing funds to produce quality science.

Other alternatives to the traditional public and private sources of funding might take the following forms:

- requiring that industries "subcontract" or give a small percentage of the "independent R and D" (I, R and D) funds they receive to university researchers to do basic research in the same topical area as the original contract;

- requiring industries that do R and D, via a tax incentive mechanism, to set aside for in-house research or research at universities, a fixed percentage of profits, for instance, like the two-percent required of some West German industries;

- developing a "superfund" for research, derived from the profits of sales of R and D intensive industries, with tax incentives to the industry, and distribution of the "superfund" proceeds to research, teaching, student training, fellowships, and precollege science.

IMPACT OF NATIONAL SECURITY AND INTERNATIONAL TRADE CONSIDERATIONS ON SCIENTIFIC COMMUNICATION AND INFORMATION EXCHANGE

Issue

With regard to policy development and implementation, it is possible either to restrict or promote, for reasons of national security or international trade, the communication or exchange of certain kinds of scientific information. Complications arise when different arms of the Government engage in both pursuits at cross-purposes, when the criteria for such activities are unclear, and when Government and the affected private interests are not in agreement about the need for, or objectives of, such regulation. Some of these complications, it may be argued, exist today.

Background

With regard to scientific communication and information exchange, national security and international trade considerations are both so-called double-edged swords. For example, during 1981-1982, some executive branch officials have sought more stringent enforcement of export control laws to limit, for reasons of national security, the communication of certain kinds of sensitive scientific information, either directly or indirectly, to foreign nationals of particular countries. Some opponents of this development have argued that national security is enhanced not by concealment but by achievement: in order for the American scientific community to excel, it must have freedom to communicate research efforts and findings so that others may verify and subsequently build upon them. Complications result, in part, because of different understandings of "national security." Reconciliation is important so that there will be minimal consequential loss of scientific accomplishment due to either "chill" on communications or "drainage" of knowledge.

Similarly, with regard to international trade, both the Federal Government and American business seek to promote the sale of U.S. goods overseas. In so doing, however, industry does not want to reveal aspects of technological capability which contribute directly to its advantage in overseas markets, and the Government does not want certain commodities, technology, or know-how to fall into the hands of nations which are considered to be ideological foes. Differences exist within the executive branch and between the Governent and industry over the realization of these objectives. The Department of Commerce, for example, has been criticized for being incapable of executing policy that simultaneously promotes American industry in foreign markets while protecting sensitive technology and know-how from ideological foes.

In view of the existing policy confusion and conflict, differing perspectives concerning national security and international trade considerations and their impact upon scientific communication and information exchange need to be reconciled through exposure to available knowledge, thorough discussion, and a balancing of competing views.

Analysis

Efforts might be made to identify and make clear, in policy terms, critical technologies which, for reasons of national security or international trade considerations, might be subjected to some kind of Government export control, types or areas of scientific communication or information exchange in need of regulation (transfer process), as well as effective mechanisms of control. Policy concepts, such as "national security," might be defined or given specific understanding; operational criteria or purposes might be established; and some consideration might be given to the means of and degree of administrative discretion to be granted by the primary policy vehicle. Relevant studies might be conducted concerning export controls and trade promotion efforts of other western democracies, the adequacy of private sector controls for protecting technology, and the possibility of building upon certain existing private sector controls to keep Government regulatory mechanisms to a minimum and to give business considerable autonomy in these matters.

U.S. SCIENCE AND ENGINEERING EDUCATION AND MANPOWER

Issue

Concern about the quality of science and mathematics education at the pre-college level is currently evident because of a shortage of physical science and mathematics teachers, and the lack of emphasis placed on these subjects by most school systems across the Nation. Similarly, the possible decline in the quality of engineering education at the college level also is a topic of concern because of an increase in engineering undergraduate enrollments and a growing shortage of engineering faculty members.

Background

The scientific strength and technological capability of the Nation depends directly on the quality of scientific education received by its students and the number of qualified individuals who enter scientific and technical fields. Currently, the United States is the world's overall leader in science and technology. There has been recent interest, however, by some Members of Congress, educators, industrial administrators, and others regarding both the current and future condition of the Nation's scientific and engineering manpower.

Several aspects of this issue are: the quality and extent of pre-college science and mathematics instruction; the current and potential shortage of high-quality college engineering faculty members; the present and possible shortage of manpower perceived in various disciplines of scientific and engineering fields; the impact of the supply and demand for scientific and technical manpower on the Nation's economy and security; as well as the concern about the training of skilled technologists for the labor force.

Analysis

In fiscal year 1982, the appropriation for the NSF science education program was the lowest in nearly 25 years--$20.9 million. The Administration's FY 1983 budget suggested eliminating all funding for NSF science education programs. Instead, $15 million was proposed for graduate research fellowships in science and engineering. The NSF would, according to its Director, help identify critical needs and encourage the participation of State and local governments, private industry, and scientific and professional organizations as well as other Federal Government agencies to contribute to the resolution of the issue.

Congress rejected the Administration's proposal and appropriated $30 million to NSF for science education--$15 million for the Graduate Fellowship Program, and $15 million for an activity at the pre-college level, upon the approval of the program plan by the Committees on Appropriations.

MINORITIES AND WOMEN IN SCIENCE AND ENGINEERING

Issue

Most minorities 1/ and women are underrepresented in science and engineering fields. Recently, there has been concern voiced about current and potential shortages of manpower, especially in the computer sciences and in certain engineering fields. Minorities and women represent possible manpower resources that are, currently, relatively untapped.

Background

U.S. minority groups comprise about 20.2 percent of the total U.S. population. Although there was a 25 percent increase in the employment of minority scientists and engineers (S/E) between 1974 and 1978, they currently represent 3.6 percent of employed S/E. Deficiencies in pre-college preparation by most minority students in mathematics and the physical sciences seem to diminish their opportunities to pursue technical careers. Subsequently, higher attrition rates are evident among minorities seeking S/E educations than among their white counterparts.

Women represent about 51 percent of the U.S. population. Between 1974 and 1978, women employed in S/E occupations increased by nearly 32 percent, but they currently constitute only 9.4 percent of the S/E workforce. Most women, as in the case of minorities, have not acquired the necessary educational preparation for careers in technical fields.

Analysis

The Science and Technology Equal Opportunities Act of 1980 (P.L. 96-516) directed the National Science Foundation (NSF) to initiate programs that would increase the participation of minorities and women in science and technology. One such program currently exists for women--The Visiting Professorships for Women in Science and Engineering. In addition, one new program has been created for minorities--The Minority Research Initiation Program (MRI)--to go along with two existing programs--Research Improvement in Minority Institutions (RIMI), and the Minority Graduate Fellowship Program. Funding for the new programs were eliminated in the March 1981, fiscal year 1982 NSF budget revision. Subsequently, however, $2.7 million was appropriated for the programs.

For FY 1983, $1 million was allotted for the NSF women in science program, $2.5 million for MRI, $2.0 million for RIMI, and about $2.0 million for the Minority Graduate Fellowship program.

1/ Ethnic minority groups that are significantly underrepresented in scientific and technical fields--Blacks, American Indians, Mexican-Americans, Chicanos, Puerto Ricans, and Alaskan Natives.

THE AMERICAN AGRICULTURE SCIENCE RESEARCH AND DEVELOPMENT SYSTEM

Issue

Agricultural products are clearly a key factor in U.S. international trade and in retaining independence from the fears of imminent starvation for citizens of the United States. Current surpluses in agricultural productivity tend to defuse any concern about long-term research needs. However, there is a growing concern that the knowledge base needed to sustain this productivity is not being managed properly to insure retention of this position.

Background

In 1969, the United States Department of Agriculture commissioned the National Academy of Sciences to "review agricultural research as a science." The results of this review appeared in 1972 in a highly controversial and critical report known as the "Pound Report." Then, in September 1982, the recommendations of a joint Office of Science and Technology Policy (OSTP)-Rockefeller Foundation report focused more intensely on many of the same critical issues identified in the earlier "Pound Report." During the intervening decade other legislative, executive, and private agency reports indicate an increasing concern about the long term future of agriculture as it will be determined by national policies for the American agricultural science research system.

Analysis

There are strong alliances in the current agricultural science research system. Current practices have evolved from past policies which created a highly successful combination of Federal laboratory, Federal/State laboratory, and university/private laboratory research systems. The several levels of administrative control produced a complex bureaucracy which will make any policy changes difficult. The shifting of political power from agricultural regions to urban regions have made it more difficult to maintain a constituency supportive of significant long-term changes in research systems. Among the many issues which seem to warrant careful examination are:

1. The alleged lack of a coherent national agriculture policy (towards which a research system should be focused);

2. The difficulty in developing national goals within a science research system which is a mix of national, State, and private near and long-term research objectives;

3. The low priority within total research and development funding presently assigned to agriculture research and development;

4. Criticism about the quantity and quality of agricultural science research and development as it is presently funded (particularly in the plant sciences);

5. A perceived inability to respond quickly to national issues;

6. A proposal for the establishment of agricultural science research centers of excellence and adoption of increased funding levels for a competitive research grants system; and

7. The need for a national synthesis of agricultural science research objectives to insure the effective funding of scientific research programs influenced by problems associated with water resource issues, multiple land use management, and the changing farm economic conditions produced by increased capital and energy costs.

PROBLEMS AND CONSEQUENCES OF BEING A RESPONSIBLE PROFESSIONAL

Issue

The concept of a professional may be understood as embodying a calling requiring specialized knowledge and often long and intensive educational preparation as well as conformity to certain technical or ethical standards of the calling. Increasingly, the professions and the public have become aware of ethical concerns associated with the development and use of science and technology. This awareness has prompted a widespread re-examination of the present status of professional conduct, self-regulation, and ethics. At present, it appears that there are not only considerable disparities among scientific and engineering societies regarding professional ethics activities, but also, perhaps somewhat consequentially, practitioners, as professionals, sometimes find themselves in a dilemma of conflicting responsibilities to different sectors of society.

Background

Part of the concept of being a professional involves ethics--rules of conduct, practices, and principles--that are intended to define the rights and the responsibilities of a calling or vocation, such as a scientist or engineer, in relationship with each other in the profession as well as with other parties, including employers, research subjects, clients, students, etc. Although these rules may be established in a variety of ways, ranging from law to traditions or customs, they frequently are the product of professional organizations and societies. This means of setting standards for professional responsibility , however, is not well developed. For example, in December 1980, a report by the American Association for the Advancement of Science (AAAS) concluded, "in general, the professional scientific and engineering societies have not developed in-depth programs addressing the ethical implications of their members' work." Thus, one problem in attempting to be a responsible professional may be the lack of obvious and generally agreed upon standards.

Another problem involves equitable and consistent enforcement of ethical standards within a profession. In this regard, the AAAS report commented that "where societies have attempted to directly intervene by supporting or sanctioning a member in response to ethical concerns, such attempts often are ineffective or are based on ad hoc procedures which do not represent a formalized concern about the significance of such actions within the profession or society as a whole."

A third consideration concerns the dilemma of conflicting responsibilities to different sectors of society. How should a sociologist studying community drug abuse problems respond to a subpoena for records revealing the indentity of suppliers and "pushers"? Should a scientist engaged in genetic engineering

research supported by Federal funds refuse to disclose results and findings which might be used for biological warfare if such data are not directly related to the primary project?

Analysis

Congressional consideration of the problems and consequences of being a responsible professional might focus on several matters. These include the extent to which the professional standards and ethics of certain professions should be honored and supplemented, either through agency regulations (including civil service regulations), or though Federal contracts and licenses, or both. In pursuing these possibilities, professional standards and ethics would have to be carefully identified and stated, and conflicts with existing laws would have to be considered as well.

Procedures and protections for Federal employees, contractors, and licensees who act as "whistleblowers" exercising professional responsibility might be examined. Also, the need and conditions for protecting individuals from compulsory legal process where questions of professional ethics are at issue is a related area for possible scrutiny.

Finally, what role, if any, should the Federal Government pursue relative to private professional organizations and societies developing and enforcing professional ethics and standards of responsibility? In this regard, the activities of the States and other democracies also might be explored.

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FORMULATING SCIENCE POLICY: ARE THERE "FORESIGHT" OPTIONS?

Issue

During the 1980s and 1990s, science and technology probably will continue to be powerful agents of socioeconomic and cultural change within the United States. Moreover, dramatic changes in any one area may affect solutions in other areas. For example, changes in information, computers, and telecommunications could affect solutions to problems in the area of transportation. National energy policies cannot be discussed independently of weather modification for agricultural purposes and acid rain. Is there a need for congressional mechanisms for making long-term scientific and technology policy more effective through the utilization of planning, forecasting, and analytical techniques currently used in the private sector?

Background

Over at least the last two decades, science and technology have been viewed as constructive as well as destructive agents of socioeconomic and cultural change. In the last 30 years, citizens of the United States have seen the definition of life and death reconsidered as abortions and life support technologies have become commonplace in the medical arena. The triumph of man on the moon now coexists with the terror and uncertainty of nuclear holocaust as well as the toxic chemical accumulation. The consequences of technological change are both supported and questioned. From a historical perspective, it appears that, in many areas, the dominant consequences of technology are increasingly not the planned consequences, but the unplanned and normally unanticipated side effects. Many of the Nation's political problems involve these side effects, which include such things as waste products and pollutants.

Business, in the past, admittedly has failed to anticipate many side effects on the consumer or the general public as well as the impact of outside influences (e.g., the Japanese imports) upon its organization. Outside influences can include international developments, economic conditions, demographic shifts, Government policies, social attitudes, technological advances, and resource availability. In an effort to get an "early warning" of the unanticipated or side effects of scientific and technological change, and the discontinuities which they cause, many corporations have established issues management and/or environmental monitoring units. Environmental monitoring is the systematic identification and tracking of external trends whose changing course could either benefit or adversely affect a particular company in the future.

Such systems also could apply to the development of public policy in the area of science and technology. Congress made some initial steps in that direction when it directed the executive branch to prepare and revise annually a Five-Year Outlook with respect to situations and conditions regarding science and technology and their applications which warrant special attention within the next five years (Title I of the National Science and Technology Policy, Organization,

and Priorities Act of 1976). The second Five-Year Outlook report was published by the National Science Foundation in 1982. The question is whether or not Congress needs to strengthen its own internal capabilities in this area beyond those committee "foresight" responsibilities required by House Rule X which requires each committee, with the exception of Budget and Appropriations, to do futures research and forecasting on a continual basis.

Analysis

Because of the Nation's traditional electoral and democratic processes, the bulk of congressional time always will be devoted to the "now" or the issue of the moment. The Nation's political system is based on "qualitative bargaining" which is incremental and fragmented. Values resolution and widespread bargaining among power centers dominate the planning process more than logical and quantitative patterns of reasoning and behavior. Yet, faced with an overwhelming number of issues, lawmakers need long-term information; criteria to judge the urgency of an issue; to ascertain when the maximum impact can be made on a trend through congressional intervention; and to determine when congressional action must be taken to avoid the unwanted consequences of an issue, or to enhance the effect of a development in a desired direction. Though there is no luck of forecasts, sound guidance of this nature is, however, notoriously difficult to secure. Action at the beginning or the early stages of the life cycle of a strategic issue provides the greatest congressional flexibility because the options and knowledge associated with the issues have not been clarified, or solidified into unworkable or unchanging positions.

ETHICAL AND LEGAL IMPLICATIONS OF NEW TECHNOLOGIES

Issue

Many technological advances have posed, and will continue to pose, complex ethical, moral, and legal questions for society. Therefore, the need to conduct assessments of new developments in high technologies continues to be critical in the congressional decisionmaking process.

Background

The term "technology" refers to the making and using of artifacts. Although much has been written about the new biomedical technologies and their implications for society, advances in agricultural, behavioral, commercial, communications, economic, genetic, handicapped, industrial, information, labor-saving, recreational, and reproductive technologies can also have far-reaching ethical and legal impacts. The generalization that technological developments increase man's need to make responsible choices may be applied in any of these areas.

Congress has demonstrated its commitment to fostering responsible decision-making in response to technological developments, through the creation of various Federal boards, offices, and commissions. The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research was created by congressional mandate (P.L. 93-348) in 1974 to consider the ethical implications of research involving human subjects. The President's Commission on Ethical Problems in Medicine and Biomedical and Behavioral Research, which has a broader scope and function than that of the earlier Commission, was created in 1979 and is authorized through the end of calendar year 1982. Reports issued by the President's Commission have covered such topics as the definition of death, the compensation of research subjects, whistleblowing in biomedical research, and, most recently, the implications of gene therapy.

Other Federal entities have included the Ethics Advisory Board (EAB) to the Secretary of DHHS (formerly DHEW), and the congressional Office of Technology Assessment (OTA). Technology assessments have been defined as "the systematic study of the effects on society that may occur when a technology is introduced, extended, or modified, with special emphasis on the impacts that are unintended, indirect, and delayed."

Analysis

The framework for proper technology assessments and consideration of the ethical and legal implications of new technologies currently exists. Evidence of continued congressional interest in the ethical and legal implications of these technologies may be found in recent hearings on gene therapy and other human applications of genetic research held before the House Science and Technology Committee's Subcommittee on Investigations and Oversight. It is clear that congressional oversight will continue in the future as new technologies are developed and give rise to a host of new ethical and legal problems.

II. AERONAUTICAL R&D

FEDERAL ROLE AND PRIORITIES IN AERONAUTICAL R&D

Issue

World competition has decreased U.S. share of the air transport market by about 25 percent in the past decade. Domestic light aircraft makers, such as Cessna and Beech have almost ceased production of smaller single engine aircraft. The production of technically adequate military aircraft is restrained, in some instances halted, due to extremely high and escalating production cost. At issue is whether an increase in Federal support for aeronautical R&D can effect the recent decline in world and domestic markets for aircraft manufactured in the U.S.

Background

With few exceptions the aerodynamic elements of aircraft have remained the same since the First World War. In general this has consisted of propulsion system mounted forward of the center of gravity (tractor style) followed by wings coincident with the center of gravity and trailed by tail section of horizontal and vertical surface to provide stability and control. The aerodynamic force from the tail section as well as its structural weight is downward, adding to the burden of the supporting wings.

Recently, highly successful small aircraft have appeared based on a canard design, in which the propulsion system is moved to the rear (pusher style) along with the wing, and a small wing, placed at the front of the aircraft, supplies positive lift and pitch control. New construction techniques have substituted plastic and carbon fibre for aluminum.

Analysis

Where risk can be minimized aerodynamic innovations which provide major gains in aircraft performance, economy and safety should be favored over innovations which may provide only incremental gains. Canard and composite construction designs in small aircraft have demonstrated efficiency gains of about 100 percent, average cruise speed advantages of 50 percent, reductions in power requirements (and fuel consumption) of 50 percent, and stall and spin resistant handling (for improved safety). The same or greater improvements in efficiency and safety may be projected for transport size aircraft. NASA's "proof-of-concept" studies of these innovations could greatly shorten the time otherwise required for commercial use of these concepts.

A problem common to all classes of aircraft manufacturing is rapidly rising costs. Federal support to develop new fabrication techniques and composite structures could prove of benefit to this industrial sector through cost reductions in fabrication as well as vehicle efficiency gains through reductions in airframe weight. The question is whether, and at what pace, the industry could support such developments without Federal funding, and whether the importance of maintaining the U.S. lead in aeronautical technology merits such Federal support.

AERONAUTICAL SAFETY R&D

Issue

Air passenger deaths frequently result from crashes which are later judged to be "survivable" crashes. What can be done to insure the survival of passengers who experience a "survivable" crash?

Background

Most aircraft accidents occur when the aircraft is landing or taking off. A loss of power, loss of lift due to ice accumulation, a wind shear at ground level, a collapsed landing gear are all factors which can result in crashes in which the ground impact does not reach a deadly magnitude. In these situations, passenger death is most commonly caused by asphyxiation from smoke or toxic fumes. Failure of the airframe may prevent the opening of escape doors. Failure of seat mounts or safety belts can result in passenger pile-up causing blocking of exit doors as well as incapacitating injury or unconsciousness.

Analysis

The prevention of deaths resulting from "survivable" crashes may be as much a regulatory issue as it is a subject for R&D. Through the years, the National Transportation Safety Board has made many recommendations and suggestions aimed at increasing crash safety similar to the following:

1. Flame suppression systems in the fuel supply as well as methods to quickly chill hot engine sections would aid in fire prevention. In cases where fire cannot be suppressed, toxic smoke concentration should be allowed to escape through emergency openings.

2. Exit doors subject to jamming when the air frame undergoes distortion might be designed to distort but not stick or to pop themselves open.

3. A passenger, properly restrained, can withstand an impact between 30 and 40 times the force of gravity (30 to 40 g's) without losing consciousness. However, only a 10 g resistance is designed into the seat and restraint.

Objections to such suggestions include the observation that commercial air transportation is already the safest mode of travel known. Adding equipment to further increase safety also increases aircraft weight as well as cost. It also decreases the payload capability of the aircraft to the extent that weight is increased. Finally, there is the possibility that a safety feature such as a pop-out exit hatch, might be accidently activated and thus be the cause of an air disaster.

R&D FOR AIR TRAFFIC CONTROL SYSTEMS

Issue

Can emerging navigation satellite systems take the place of the planned multibillion dollar upgrade of the FAA Air Traffic Control system?

Background

The idea that ground stations should manage enroute air traffic may have been more appropriate during the early years of air travel than it is today. Radar emerged during WWII and made possible the philosophy that aircraft were best managed from the ground, by agency personnel and with equipment owned by the agency. FAA is presently planning a new facilities improvement program, which it would own and operate, although new technological alternatives for meeting air traffic control needs may now be available.

Analysis

Although major airports are crowded and could not be operated without traffic management, both aerial and surface, the enroute airways have never been crowded. In contrast, the FAA Air Traffic Control centers, according to the men who run them, operate like "pressure cookers", narrowly avoiding total saturation by periodic upgrading.

Now, at the onset of the largest and most costly upgrading in history, some question exists as to the continued need for these centers. Both the USSR and the United States are installing navigational satellite systems. These systems enable any vehicle to fix its own location with accuracy world wide. This type of satellite also has the capability of supplying tracking data to a ground station.

On board collision avoidance equipment is available to supply aircraft separation information.

It is possible that a large part of the new FAA National Aerospace System Plan may be redundant and less capable than other available systems. The management issue here is whether or not FAA should assume that it must own and operate all equipment required to meet its assigned responsibility for air traffic control. Can navigational satellite systems become universally used soon enough to eliminate the need for an improved ground based system? Will the capabilities of the new system result in improved air safety?

AIRPORT AND AIRWAYS TRUST FUND

Issue

With the reinstatement of the Airport and Airways Trust Fund in the 97th Congress, oversight of spending from the Fund will be of continuing concern to Congress.

Background

After almost two years of debate, Congress passed the Airport and Airways Improvement Act of 1982, which reinstated the Airport and Airways Trust Fund through FY87. The Act is embodied in Title V of the Tax Equity and Fiscal Responsibility Act of 1982 (P.L. 97-248). The Act authorizes spending from the fund for the airport development aid program (ADAP), for facilities and equipment (F&E), for research and development (R&D), and for a portion of the Federal Aviation Administrations' (FAA) operating expenses. Major changes from the previous program are the levels at which FAA operating expenses will be defrayed ($6.6 billion) through fiscal year 1987 and the amount of funding for F&E ($6 billion) during the same period.

The FAA is expected to use a considerable portion of these funds to begin modernization of the air traffic control system (ATC). This program would increase the capacity of the ATC system, and reduce its operating costs through the elimination of requirements for new controllers. If fully implemented, the program could result in expenditures of up to $10 billion over a ten-year period.

Analysis

Increasing the trust fund contribution toward FAA operating expenses was seen as the most controversial aspect of the Act. Critics of this increased spending fear that it sets the stage for further diversion of trust fund money to activities that do not result directly in an upgrading of the airport and airway system. Close oversight of how the FAA spends its operating funds therefore seems essential.

The FAA's proposed modernization of the ATC system, which is partially funded in this Act, is also somewhat controversial. There are those that contend the FAA approach is too technologically oriented, relying on systems that do not yet exist. It is therefore important that FAA spending on ATC modernization be continuously monitored to insure that systems perform as predicted and at cost levels in keeping with total plans.

The President's Science Advisor has recently come out in support of aviation-related R&D. To some degree this represents a change from the Administration's previous thinking on the subject. The aviation community has drawn attention to a number of R&D needs. There is not enough authorized funding to support all of these needs, and determining the most promising among them will probably be difficult.

The ADAP program is essentially unchanged from the program that had expired when previous authorizing legislation expired in 1980. The major issues that have been raised about the program over the years concern the speed of FAA project approval, and FAA distribution of discretionary funds. These issues can be expected to arise again under the new program.

III. ENVIRONMENTAL R&D

FEDERAL ENVIRONMENTAL R&D FUNDING AND MANAGEMENT

Issue

Since FY 1981 EPA's R&D budget has been reduced significantly, raising a series of policy and management questions. Have the reductions reached the point where some programs should be eliminated and the funds shifted to maintain higher levels of work in fewer areas? Is there a need to consolidate laboratories, to maintain efficiency and effectiveness? Would cost-sharing arrangements be appropriate to extend funds--for example, requiring industry to share R&D costs for control technologies, or States to share funds for research on localized problems, e.g., the Great Lakes?

Background

The organization and management of EPA's R&D program has always been controversial. A number of studies and reports containing criticisms and recommendations for change have appeared over the past 10 years. EPA's R&D appropriations hovered around $175 million for FY 1972 through FY 1977, then grew rapidly to $253 million for FY 1981. Justifications for the increases included inflation, the need to assess environmental impacts of energy programs, the increasing problems associated with regulating toxics, and the perception that "better science" was needed to substantiate regulatory decisions. But since FY 1981 EPA's R&D budget has plummeted over 50 percent, to $119 million for FY 1983 (considering inflation, the drop would be even greater). The reductions have been justified on the grounds of greater efficiency, the completion of regulatory decisions for which R&D had been required, and reduced needs for R&D for conventional pollution programs.

Given the magnitude of the reductions, some R&D programs may have been cut below levels at which they can be productively maintained. If so, decisions will be required on whether to drop some programs entirely in order to fund at more productive levels others; or to consolidate related programs to maintain a "critical mass." The same issue arises for EPA's research laboratories: some labs may no longer be efficiently utilized, raising questions about possible consolidations of programs.

Analysis

Congress has supported the budget reductions. Both the House and Senate in 1982 rejected amendments to keep EPA's R&D funding at FY 1982 levels, though the enacted appropriations were higher than the Administration requested. At the same time, Congress directed that some of the added monies be expended on specific programs, including indoor air pollution and acid rain studies. Also, Congress approved funding of R&D under the "Superfund" Act by appropriating monies from the fund itself. This raises the issue of possible cost-sharing schemes for other R&D programs, either from industry or States.

Finally, concern exists over the Administration's commitment to environmental R&D programs: the post of EPA Assistant Administrator for R&D has been held by several persons in the current Administration, and the present Administrator is still in an "Acting" capacity.

MONITORING AND ENVIRONMENTAL QUALITY MANAGEMENT

Issue

While pollution control measures are designed to maintain and enhance environmental quality, direct measurements of environmental quality trends are not sufficiently complete or reliable to permit full assessment of the impacts of policies. The Environmental Protection Agency's monitoring programs have long been criticized as inadequate--most recently in a General Accounting Office report on air quality monitoring. How and whether to translate the perceptions of inadequacies into improved programs is the issue--particularly in this time of budget constraints.

Background

Environmental monitoring serves several purposes: to establish baselines of environmental quality; to measure trends in the changes of environmental quality; to provide evidence for enforcement of pollution control requirements; and to identify new, potentially harmful contaminants. A National Academy of Sciences' review of EPA's monitoring programs in the mid-1970's said "the nation's information on environmental quality is deplorably and unnecessarily bad." Subsequent investigations by the House Committee on Science and Technology, Subcommittee on the Environment and the Atmosphere confirmed many of the problems.

Criticisms of Federal environmental policies and programs revolve around two subissues. One concerns the lack of a coordinated, comprehensive national program. While much monitoring is currently conducted, the programs are too often noncomplementary and the data incompatible. A Council on Environmental Quality interagency task force inventoried and assessed Federal monitoring programs in 1978 and 1979, and identified eight areas of concern, "including a need for improved coordination in the gathering of environmental data and better quality assurance." Four of the task force's recommendations were (1) to establish a National Ecological Program; (2) to continue U.S. support for international data and monitoring programs; (3) to improve quality assurance; and (4) to strengthen mechanisms for environmental data exchange between Federal and nonfederal agencies.

The second monitoring subissue concerns the shortcomings of EPA's programs. While EPA has reassessed its programs and implemented a number of improvements, the programs apparently remain inadequate. In 1980 the General Accounting Office reviewed water quality monitoring programs of EPA and the Geological Survey and concluded they "are not reliable." GAO recommended that the present program based on fixed station, fixed sampling intervals be replaced with a program based on special studies. In 1982 GAO reviewed EPA's air quality monitoring and concluded that EPA's progress in implementing its statutory mandate to establish a nationwide air quality network "has been slow and costly and has not yet resulted in full implementation of a reliable air monitoring network." Besides recommending that EPA ensure better compliance with quality standards,

GAO recommended that the Congress set a "deadline by which the [air monitoring] networks must be operational."

Analysis

Complicating efforts to establish satisfactory environmental quality monitoring programs are money constraints; technical problems; difficulties in coordinating disparate progams at various levels of government, as well as between the public, academic, and private sectors; and, perhaps most important, the varying implications of the different functions for which monitoring can be undertaken.

Ultimately, then, issues include whether some Federal institutional mechanism for orchestrating environmental monitoring is needed; whether more money is needed or only better management of existing programs; how to ensure long-term stability of monitoring programs, both financially and institutionally; and how to store, analyze, and make available the results of the data collected.

ENVIRONMENTAL REGULATION AND ITS IMPACTS ON INNOVATION

Issue

Concern has been expressed about two kinds of impacts on innovation of environmental regulation. First, that present regulatory programs tend to inhibit innovation in pollution prevention, particularly in the development of new processes to minimize emissions. Second, that regulatory requirements inhibit innovation of new products, e.g. drugs, pesticides, and chemicals. Particularly as the Toxic Substances Control Act is implemented, its effects on innovation will increasingly be debated. At issue is whether these concerns are are valid; and then, if they are, what actions Congress might take to resolve them.

Background

One implication of environmental regulations is that they change the economics of innovation--typically, by increasing the risk involved. In meeting pollution control requirements, it is usually less risky to choose an existing pollution control technology which the regulator in effect has sanctioned than to choose a innovative technology that may fail and thereby expose the pollutor to penalties. In developing new products such as drugs or pesticides, regulations requiring testing to anticipate hazards raise the cost of development and delay the introduction of new products.

A second implication of the regulatory process is the increased public access to industry information traditionally treated as confidential. If health and safety data is to be accepted by the regulator, it must somehow be verified, either within the agency or through peer and public interest review. Regulation typically has given the public access to health and safety data, but how to draw the line between trade secrets and public information remains poorly defined.

Analysis

These issues raise for the Congress a host of legislative problems. First, the pollution control statutes themselves in some ways tend to inhibit innovation in pollution control. For example, under the Clean Air Act the procedures for getting a permit for an innovative control process are complicated, time consuming, and leave the innovator exposed to penalties if the process does not prove out. Second, tax law does not give write-off benefits for innovative process changes that reduce pollution, while installation of end-of-pipe controls do get such benefits. Third, statutory provisions concerning trade secrets on the one hand and public access to health and safety data on the other continue to be controversial. The 97th Congress tried to resolve problems with the availability of data submitted for pesticides registration, for example. Fourth, the delays in commercialization of regulated products such as drugs and pesticides mean that patent protection is of less value, since much of the period of protection may pass before the product can be marketed. The 97th Congress considered legislation to extend patent production in such cases.

These and related issues will doubtless resurface in the 98th Congress.

ATMOSPHERIC RESEARCH CONCERNING IMPACTS OF HUMAN ACTIVITIES

Issue

Human activities are producing a number of emissions that may have large scale impacts on atmospheric processes and on critical environmental factors--including climate, radiation reaching the earth's surface, the acidity of percipitation, and others. The adequacy of research to anticipate the dimensions of these potential changes and to develop possible remedial actions is open to question.

Background

The scale of human activities has reached the point where the polluting consequences of some of them are overwhelming natural processes of restoring normal equilibria. In particular, emissions from human activities appear to be changing global atmospheric processes in ways that may threaten environmental quality or human health. At present, the emissions of greatest concern include carbon dioxide, chlorofluorocarbons, and sulfur and nitrogen oxides.

Analysis

Although a minor constituent of the atmosphere, carbon dioxide plays a major role in the processes affecting the earth's heat balance. The level of its concentration has been increasing, largely as a result of the combustion of fossil fuels and to some extent because of the cutting of forests. It is widely believed that increases in carbon dioxide sooner or later will result in global warming, but there is disagreement on how much, in what pattern, and with what consequences. Considerable research assessing possible consequences has been done; so far, there is no agreement that the predicted global warming has been detected, and uncertainty about the magnitude and significance of potential effects. Given the possible magnitude of the effects, however, the adequacy of the research efforts is open to question. And if the probability of substantial adverse effects becomes more certain, the issue arises of whether energy policies should foster noncombustion processes--for example, nuclear power.

Chlorofluorocarbons are chemicals used in several industrial processes, most importantly as heat transfer fluids, for example in refrigerators and air conditioners. In the early 1970s theoretical analyses suggested that emissions of these chemicals could deplete atmospheric ozone, with possibly deleterious consequences--primarily by allowing greater amounts of potentially damaging radiation to reach the earth's surface. Extensive research to delineate the potential problem has been conducted, concurrently with regulatory actions to decrease emissions. However, substitutes for remaining uses are unavailable or themselves pose serious problems, and the issue of whether, when and how to further regulate chlorofluorocarbons remains. The Clean Air Act contains a provision allowing the EPA to regulate the substances as necessary, but proposals for regulation were dropped by the current Administration. Legislation

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to prohibit further regulation unless Congress finds that research confirms its need has been proposed, but not enacted.

Sulfur and nitrogen oxide emissions are widely believed to contribute to acid percipitation. Over the past few years scientific understanding of atmospheric processes leading to acid rain and of its impacts have increased rapidly, although the precise processes and specific consequences remain elusive. Today, the issue seems to have moved from whether there is an acid rain problem to how and when to deal with it. Legislation to cap sulfur oxide emissions and to reduce them over the next 10 to 15 years was considered by the 97th Congress, but no final resolution was achieved. In the 98th Congress, key issues will include whether enough is known scientifically to assure that actions taken to reduce precursor pollutants will result in reductions in the acidity of precipitation; how much reduction can reasonably be called for; whether reductions in nitrogen oxides should be credited against sulfur oxide emissions; and how maximum flexibility and cost-effectiveness can be built into any regulatory requirements.

These problems raise three basic policy issues. One, the adequacy of Federal research programs to generate necessary information to define and deal with them. Two, the adequacy of international mechanisms to respond to such global problems. And three, the responsibility for judging when remedial actions may be warranted despite uncertainty.

ACID RAIN

Issue

While legislation to control acid rain was introduced and considered in both the House and the Senate as part of the Clean Air Act Amendments, the legislation died. The issue will therefore return in the 98th. At issue are a host of questions. For example: (1) Is enough known scientifically to assure that actions taken to reduce precursor pollutants will result in reductions in the acidity of precipitation? (2) If so, how much reduction can be reasonably called for? (3) Should reduction include nitrates as well as sulfates (NOx as well as SOx)? (4) How can maximum flexibility be built into any regulatory program as well as making program most cost effective?

Background

Congress passed legislation in the 96th Congress mandating increased research on acid precipitation (Title VII, Energy Security Act, P.L. 96-294). The Act created an Acid Precipitation Task Force and authorized $50 million over a 10 year research program.

In the 97th Congress demand grew for legislation calling for a reduction in acid rain precursors (mainly sulfur oxides and nitrogen oxides). Several bills were proposed on both sides calling for actions ranging from more research to creation of a 31-state acid rain mitigation region in which sulfur oxides reductions of up to 10 million tons would be required. Costs of the proposed reductions vary but have been conservatively estimated by several organizations to be between $2 billion and $6 billion annually. Increases in electricity rates to consumers due to this action might in some cases be as high as 25 percent but are in general much less (in the 5-10 percent range).

Proposed legislation calling for an 8 million ton reduction in sulfur oxides was reported out by the Senate's Environment and Public Works Committee as part of their Clean Air Act amendments. Similar legislation did not get out of the Energy and Commerce Committee on the House side.

Analysis

Whether an acid-rain mitigation bill is passed by the 98th Congress depends upon the degree to which members become convinced that existing research has demonstrated the causal relationship between sources of pollution and the acidity of precipitation; the existences of a widespread threat to health and the environment from acid precipitation; and the probability that reductions in precursor emissions will, in fact, abate the acidity of precipitation at reasonable costs. How well current R&D will address these crucial questions is arguable.

Thus, Congress can be expected to examine at length questions such as: (1) What is the status of the acid rain R&D program? (2) What kind of pollution control devices are available or under development to reduce acid rain precursors? (3) What are the most cost effective mixes of pollution control in a strategy designed to bring about a given reduction of acid rain precursors?

HAZARDOUS WASTES: EPA'S IMPLEMENTATION AND SUPERFUND'S SOLVENCY

Issue

Critics, both in Congress and without, have charged the Environmental Protection Agency with dragging its feet in implementing the Resource Conservation and Recovery Act and the Superfund Act to control hazards from hazardous waste sites. A particular question is how far the $1.6 billion authorized to be collected by the Superfund Act will go in cleaning up the estimated 1000-2000 health or environmentally threatening sites around the country.

Background

The accusation of EPA's tardiness in implementing the Superfund Act derived primarily from two things. First, the agency missed by about a year the deadline for issuing the National Contingency Plan (NCP) for responding to hazardous substance spills and releases. Previously prepared regulations proved unacceptable to the Reagan Administration and they were required to be redrafted. Second, the agency was accused of deliberately delaying the expenditure of Superfund monies. The agency claimed that the delay in issuing the NCP was unavoidable given the complexity of the issue, and that the Superfund monies would flow rapidly once preliminary assessments were completed and cleanup plans of action were determined. Work of one type or another is proceeding at those sites; in some places litigation against the generators and/or the disposers of the waste is also going forward. Nevertheless, critics maintain that cleanup activities and enforcement actions could be pursued more vigorously, and that EPA and the Office of Management and Budget have only to request more funds to hire additional personnel to carry out the Act and Congress would be quick to oblige.

Analysis

Closely related to these issues and one of the alleged reasons for delay is the size of the fund: $1.6 billion to be collected over 5 years. In 1981 EPA maintained that amount would be sufficient to clean up only about 170 sites, a small fraction of the estimated 1000-2000 threatening locations. How far the fund would actually go was understandably difficult to estimate because enforcement actions (where the waste generators and dumpers could be identified and prosecuted) would reimburse the fund to some degree--although as of October 31, 1982, only $2.3 million had been recovered from responsible parties. As the law required, EPA published its first National Priority List of response target on December 20, 1982; it consisted of 418 sites. It remains to be seen how many cleanups will actually be accomplished.

Already some observers have raised the question of the need to extend (and possibly increase) the Superfund tax on the chemical and other industries that pay into it. As of October 31, 1982, Superfund receipts, including appropriations, amounted to $514.8 million, and $92.7 million had been transferred to EPA. Moreover, funds for EPA's R&D under the Act were authorized to be taken from the fund.

OCEAN DUMPING

Issue

Over 10 years ago, Congress adopted an ocean waste disposal policy which gave special protective consideration to the oceans and sought to strictly limit or prohibit most ocean dumping practices. This policy is now under re-examination as new pressures mount to expand ocean dumping activites. Evaluation of past ocean dumping activities has been difficult due to inadequate data about the effects of substances and about specific disposal site conditions. Since recent budget reductions have substantially reduced ocean dumping research, this data gap will not soon be narrowed. Congress will undoubtedly continue to define the ocean's waste disposal role and probably address the adequacy of research on the fate and effects of ocean disposed substances.

Background

Based on the recomendations of the Council on Environmental Quality's (CEQ) 1970 report (Ocean Dumping: A National Poicy), Congress enacted the Ocean Dumping Act, the first two titles of the Marine Protection, Research and Sanctuaries Act (33 U.S.C. 1401 et seq.) The act bans ocean dumping of high level nuclear substances, chemical warfare agents, and several highly toxic substances, but allows permitted dumping for substances deemed not "harmful". The Act also establishes a research and monitoring program, and conforms U.S. ocean dumping programs with the International London Dumping Convention, ratified by the United States.

Municipal sewage sludges and dredge spoils account for most of the volume of ocean disposed materials. Some progress has been made in encouraging communties to seek other alternatives for municipal sewage sludges, while little has been done in developing alternatives for dredge spoils which comprise over 90% of the volume of ocean disposed materials.

Developing criteria upon which to assess whether a substance was harmful or not proved to be a substantial barrier to smoothly implementing the rest of the Act. EPA adopted a strongly prohibitive approach in its early regulations and criteria. Only recently, a court suit (City of New York v. EPA) remanded these criteria back to EPA for revision. The Court held that EPA could not prohibit sewage sludge dumping without balancing all public interest factors, so EPA's past regulatory approach will presumably change.

There is mounting pressure to rethink the "strictly limit or prohibit" policy, to investigate expanded use of the oceans for waste disposal, and to weigh ocean dumping against other disposal alternatives in a more complete cross media assessment.

Analysis

The total volume of substances disposed in the ocean - mostly sewage sludges and dredge spoils - has increased in the last decade despite the regulatory program of the EPA. Internationally, the same thing has happened. To add to this, substantial increases in sewage sludges, higher in toxic pollutants due to increased treatment, has caused several coastal municipalities to look more favorably on ocean disposal. As for dredge spoils, no dent has ever been made in the volume disposed, and they too are at times high in toxic pollutants.

Many argue that, on balance, ocean dumping is frequently less harmful than land and/or air disposal alternatives. The economics of the issue looms as almost a deciding factor. The cost of land sites near major municipalities coupled with mounting public opposition to such sites have tipped the balance making ocean disposal look more favorable. The public is acutely aware and well organized in opposition to the siting of new land facilties. The oceans on the other hand have a limited constituency, with ocean sites being fairly remote.

Protectors of the oceans argue that scant data exists on the effects of ocean dumping and the characteristics of sites. Many years of research and monitoring still have not given Congress and EPA concrete information upon which to soundly implement an ocean disposal policy. A key problem to developing such information has been the lack of baseline data upon which to judge effects. The Administration's decision to reduce the National Oceanic and Atmospheric Administration's ocean dumping research and monitoring budget by two-thirds in FY83 cannot be expected to close this data gap.

DRINKING WATER--GROUNDWATER QUALITY

Issue

Many of the Nation's aquifers, or supplies of groundwater, are threatened today as a result of chemical contamination. Sources of contamination include hydrocarbons, chlorides, heavy metals, and nitrates from surface waste impoundments; landfills; agricultural activities; and leaks and spills. At present, groundwater supplies 25 percent of the Nation's freshwater and 50 percent of its drinking water supply. Moreover, groundwater withdrawals have increased 4 percent annually during the past 25 years, raising concern about availability of groundwater supply as well as the quality of supply that is available. While some Federal, State, and local authorities for protecting groundwater exist, at issue is the adequacy of existing authorities and whether stringent Federal controls may be warranted.

Background

As a resource, groundwater is vulnerable to contamination, because it lacks the self-cleansing or waste assimilative capacity of surface water. Unlike pollution of the air or surface waters, in most cases of groundwater pollution there is lengthy delay between the time when the contamination event occurs and the time of detection. Similarly, groundwater pollution travels slowly. Groundwater pollution which occurred decades ago may only now be appearing in parts of aquifers that are used for water supply. Likewise, groundwater pollution occurring today may not appear for another decade or more.

The immediate issue is how best to protect the Nation's groundwater from further contamination. A number of Federal laws deal in part with groundwater protection. They include the Safe Drinking Water Act, the Federal Water Pollution Control Act, the Resource Conservation and Recovery Act, the Toxic Substances Control Act, and the National Environmental Policy Act. A key question is whether these combined authorities provide an adequate basis for protecting groundwater or whether a single, comprehensive groundwater law is needed. At the same time, environmentalists have criticized the Environmental Protection Agency for not making full use of existing powers, such as Safe Drinking Water Act authority, to control deep well injection of wastes and other material.

At the State level a mixed picture is evident. Differing States have differing perceptions of the importance of protecting it. Some States have specific quality standards for groundwaters, while many others do not. Few have comprehensive programs to protect groundwater, and practical authority often is fragmented between public health agencies, State water commissions, and other departments. In addition, a number of local governments have established groundwater protection programs, using zoning and similar local government powers.

(3.8 continued)

Analysis

The Reagan Administration is preparing a groundwater protection strategy which is expected to be completed in September 1983. Developing such a strategy raises questions and issues which the 98th Congress may examine.

--Is there need for a national groundwater policy? What should the goals of such a policy be? (For example, should a management program aim at protecting all groundwater up to some specified level, such as drinking water standards, or only those groundwaters used as drinking water sources?)

--What are the appropriate roles for Federal, State, and local governments, as well as private interests, in protecting groundwater quality?

--Management issues include consideration of whether, for example, to classify groundwaters by use, to impose uniform requirements everywhere, or to classify sources of pollution.

--Technical issues include assessing the state-of-the-art of identifying and monitoring groundwater pollution, groundwater protection technology, and remedial measures.

OVERSIGHT OF INTERNATIONAL ENVIRONMENTAL RESEARCH AND MONITORING:
ADEQUACY OF CURRENT DATA AND THE U.S. ROLE

Issue

Numerous international resource and environmental problems have been described in well-publicized reports and international conferences. The Global 2000 report of the U.S. Government is one of the more prominent examples. In some cases, there is broad consensus on the nature of the problem and likely trends; in others, the data are subject to disputes over accuracy, and interpretations of their implications vary widely. The U.S. has played a central role in the international data collection and monitoring efforts. Two major questions arise in connection with this issue: (1) how adequate and how accurate are international data collection and monitoring systems, and (2) how important is the U.S. role in these programs--if cutbacks in the U.S. participation occur, what are the implications for U.S. interests and for international resource policies?

Background

Since the early 1970s international efforts to monitor global natural resource and environmental trends have accelerated. The importance of establishing such trends to individual nations was stressed at the Stockholm Conference on the Human Environment in 1972; the U.N. Environment Programme (UNEP), which was set up following that conference, has coordinated several monitoring efforts. The Global Environmental Monitoring System (GEMS), carried out under the auspices of UNEP, has obtained cooperation of other international agencies and governments to establish a monitoring program to obtain baseline data and measure trends in such areas as atmospheric changes, climate changes, regional ocean pollution, deforestation, and desertification. In the data collection efforts around the globe, the U.S. has been a major supporter--both in terms of providing funding and in terms of carrying out monitoring programs which contribute to them. Data on resource use, demand and supply are collected by various international agencies, such as the World Bank and OECD. Although the data produced through these efforts become the basis for policy decisions by the international agencies and by the U.S. Government, there are wide disparities among key issues areas in the adequacy of the data, in the degree of consensus achieved on what the trends are, and in the satisfaction of leading scientists concerning the methodologies involved.

Analysis

International natural resource trends and environmental issues have important implications for U.S. domestic policies in natural resource management and pollution control, as well as for U.S. aid policy and support for international environmental organizations such as UNEP and others. The fact that the accuracy of the measurement of such trends is often called into question is of concern to the Congress in making decisions in all these policy areas. Oversight efforts would involve: (1) assessing the accuracy of major global data collection and monitoring programs; (2) clearly defining the U.S. role in supporting and contributing to these efforts; and (3) evaluating the policy implications of the U.S. role in these programs, and the implications for U.S. policies in other areas if there are cutbacks in U.S. support for international environmental monitoring programs.

EFFECTS OF AIR POLLUTION ON AGRICULTURE

Issue

Are current air pollution regulations adequate to protect the nation's agricultural productivity and still sustain a viable industrial economy?

Background

The Clean Air Act Amendments of 1970 (P.L. 91-604) established a procedure for setting primary national air quality standards to protect public health and for secondary national air quality standards to protect public welfare. Public welfare includes the production of crops and livestock, as well as property, aesthetics and personal comfort. The primary standards were to have been attained by May 31, 1975, and the secondary standards were to be attained as expeditiously as possible. However, attainment of primary standards has been postponed until the end of 1982, and in some particularly difficult cases, such as ozone and carbon monoxide, until 1987. Review and reauthorization of the Clean Air Act was on the agenda of the 97th Congress, but was not completed; the issue will therefore confront the 98th Congress.

Growing plants are particularly susceptible to pollution with reduction in growth occurring before visable symptoms of injury are noted. Damage directly linked to industrial and municipal pollution, extending many miles beyond the sources of emission, has reduced crop and forest yields. In addition to the direct effects of pollutants, crops and forests are affected by pollution-induced acid rain. Estimates of nationwide crop yield losses range between 1 and 2 percent, however some localities experience greater damage. Research studies at Riverside, California indicate that local ambient air quality can reduce certain crop yields by as much as 75 percent. Expanded use of fossil energy, in the absence of stringent pollution controls, could spread and accelerate this phenomenon.

Policy Questions

The 98th Congress is likely to be confronted with the issue of whether or not attainment of primary air quality standards should be postponed or relaxed. The decision on this issue will rest in part on the effects on the economy from the cots associated with air pollution controls. Balanced against the cost of pollution abatement should be questions about the costs associated with air pollution impacts, including the impact on food and fiber production.

(1) Are current secondary air quality standards adequate to protect the nation's agriculture?

(c) Should the U.S. Department of Agriculture (USDA) have greater input in setting air quality standards?

(2) Is additional pollution control research and development needed to assist industry in meeting air quality standards?

(3) Are current quantitative estimates of the impact of air pollution on agriculture adequate to set air quality standards on their costs and benefits?

(a) What are the frequency of occurrence and variation of concentration of ozone throughout the agricultural regions of the United States?

(b) What are the dose-response relationships for the major economic crops and the principal air pollutants--ozone, sulfur dioxide, nitrogen dioxide and other chemicals.

MINING ACT AND RECLAIMING LANDS

Issue

Should the Surface Mining Control and Reclamation Act be reviewed and amended to permit alternatives to the prescribed reclamation requirements.

Background

In 1977, Congress passed the Surface Mining Control and Reclamation Act to eliminate the environmental abuses from the surface mining of coal. The environmental protection performance standards contained in the legislation are relatively specific and require the individual States to create their own programs consistent with the requirements of the law and Interior's regulations before they can impose their own regulatory programs. Ultimate State regulation (consistent with a Federally designed program) was one of the fundamental intentions of Congress. The States and the industry have complained that consistency with the Federal regulations impairs the application of alternative reclamation practices that would be less expensive for the industry, less involved to regulate, and would be just as protective for the environment.

Analysis

Through the application of the experimental practices provisions of the Surface Mining Act, the industry has been able to apply some alternatives to the prescribed reclamation techniques outlined in the original surface mining regulations. Some of these alternative practices have worked in certain instances but the scope of application of the alternatives has not been proven. An example of these alternatives has been the mixing of soil horizons for agricultural purposes in lieu of re-structuring the individual horizons as required by the law and the regulations. Soil mixing has improved agricultural productivity at certain minesites. The Committee may wish to examine the feasibility of the proposed alternatives in order to determine the extent to which they will require adherences to environmental protection standards but yet provide the industry and the state regulatory agencies with more flexibility. By making such a determination, it may be possible to legislate these changes rather than extend them on a short term basis (through the regulatory process) which creates problems for the States, the environmental lobby, and the industry.

ENVIRONMENTAL IMPACTS OF ENERGY TECHNOLOGIES

Issue

During the 97th Congress, the Administration proposed significant reductions in the DOE environmental budget and research and development efforts to develop cleaner energy technologies (such as limestone injected fluidized bed reactors). This combined with reductions at EPA has raised concern in the Congress regarding the future environmental impact of energy technologies. One expression of this concern was a proposed SO2 reduction program to mitigate the effects of acid rain. Others were illustrated by the debate on the Clean Air Act. With action still pending on these enactments, such conflicts will continue in the 98th Congress.

Background

Environmental impacts from energy technologies can be organized under four basic categories: (1) Land Impacts, (2) Water Impacts, (3) Labor Impacts, and (4) Emissions and Effluents. Land impacts include strip-mining, reclamation and related impacts resulting from any increased population brought in to operate the plant. Water impacts include the consumptive use of water by plant processes (particularly cooling towers) and mine dewatering. Labor impacts include the infrastructure needs for an increasing population (sewers, roads, etc.) and recreation needs. Finally, air emissions and wastewater effluents impacts include health dangers from air and water pollutants and environmental problems caused by acid rain.

During the 97th Congress, various initiatives were undertaken to change the regulation of these environmental concerns and cut funding for some research and development on technologies to mitigate environmental concerns. In particular, the fossil fuels research and development was reduced by 50 percent. Executive action was taken in an attempt to loosen reclamation requirements. Finally, legislative remedy was sought to change air emissions regulations.

Analysis

There are two issues involved: the regulation of current and future conventional energy technologies, and the funding of research for emerging technologies. On the first point, the discussion has been based on a perceived tradeoff between economic recovery and environmental protection. The Administration has argued that some environmental laws are too burdensome and overly restrictive and that regulations could be changed without sacrificing environmental protection. Opponents argue that the costs are not great and the current regulations are needed.

On the second point, the Administration has argued for funding of "long-term high-risk" technologies, but the Administration believes many of the new, cleaner, energy technologies do not qualify. Opponents disagree, arguing that the marketplace discriminates against new technologies and therefore more government assistance is needed.

IV. ENVIRONMENTAL HEALTH R&D

AIR POLLUTION HEALTH EFFECTS RESEARCH

Issue

The Clean Air Act (CAA) and Amendments are undergoing the process of reauthorization. Arguments spanning the entire range have been made that, on the one hand, the CAA is inadequately protecting human and environmental health, while on the other hand the CAA is unduly restricting economic growth. Research of the health effects of air pollution could provide useful indications of the directions and magnitudes of effort needed to provide for the reasonable protection of human and environmental health. How much to pay for this research, at what rate, and who should pay are matters of current controversy, as are scientific issues like where, how, what, and when to monitor, the relationships of emissions to health, and the roles of stationary and mobile sources in adversely affecting the health of humans, the environment, and the economy.

Background

Legislative and regulatory efforts to protect human and environmental health from adverse effects of air pollution have long been the subject of review and criticism. The role of the Federal Government in protecting health (human, environmental, and economic) was unclear. The process by which these three forms of health were to be optimally procured, protected, and promoted was even less clear. Current efforts to reauthorize the CAA have again clearly illustrated the problems in attempting to satisfy seemingly conflicting interest groups. While no reasonable person has objected to protecting human or environmental health from adverse effects of air pollution, controversy exists over the procedure, rate, and goal of the protection program.

The choice of the procedure, rate, and goal of the program must rely upon more than scientific information and analysis. But the choice cannot be made without sound and adequate scientific information and analysis. Sound scientific research can describe the relationship of air pollution to health, can depict or project the magnitude of the situation, can suggest means of reducing or eliminating adverse health effects, and can forecast the rates of change of the situation. Scientific research cannot necessarily determine the optimal level, rate, or source(s) of funding.

Analysis

Controversy arose and continues over the issues of: the validity of the science underlying the policy; who to protect and at what level of protection (should we protect even the most sensitive person with a margin of safety?); who needs to clean up; how much needs to be cleaned up; how quickly should the clean up be accomplished; at what cost; and who should bear the cost.

Many legislative, regulatory, and judicial battles have been fought over these issues, and the issues have not yet been completely resolved. Scientific research can generate information and analysis which can be instrumental in resolving these issues.

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Of current concern are the validity of the underlying science, and the level of funding of the research. Some arguments have been made that the basic science underlying the regulations is weak in spots because the Federal funding was already at suboptimal levels and is declining, while other arguments are made that simple Federal funding is inefficient and inequitable, and alternative sources of funding must be pursued. Sound and adequate scientific research is a continuing component of policymaking in order to provide for the reasonable protection of human, environmental, and economic health.

SCIENTIFIC INFORMATION AND ENVIRONMENTAL HEALTH REGULATORY POLICY

Issue

Scientific issues are becoming increasingly complex. As such, policymaking involving scientific issues are also becoming increasingly complicated. At issue is the proper management and use of science in policymaking.

Background

Protecting human and environmental health from past, present, and future hazards relies greatly upon the clear and thorough understanding of the physical and natural processes involved, and upon the full utilization of that knowledge in policymaking.

As scientific issues increase in complexity, as scientific research becomes increasingly costly in these austere economic times, and as the impacts of scientific research expand, it becomes increasingly important to properly manage and use science in policy.

Concern has been expressed in the scientific community that potentially important research is not being funded, that potentially vital findings are not being considered, that "bad science" (tenuous assumptions, unreasonable hypotheses, lax adherence to accepted research protocol, questionable statistical inferences, outright errors, and biased reporting) is being used as the basis for important policies, and that scientific information and analysis are being selectively used and reported in policymaking.

Analysis

Sound environmental health policy must rely on sound environmental health science. The extent to which scientists who have been monitoring contracted research have expressed their concern that environmental health policies are being based on less-than-complete and/or less-than-sound science, seems to warrant general concern over the adequate protection of human and environmental health. Private decisions to reevaluate already regulated compounds with no known new research, and decisionmaking made in spite of contrary previous scientific recommendations with no known new studies to warrant reversal, contribute to the position that policymaking should be separated from scientific research; all policy decisions, whether to regulate or not, should be accompanied by clear statements of supporting science and reasons for rejecting contrary scientific findings. Presently, scientific and public review of documentation supporting a decision to not regulate is not required. Since the protection of human and environmental health can be equally impacted by a decision not to regulate as one to regulate, arguments have been made to require an equal burden of proof in both directions, and to require only traditional, open peer-reviewed science, properly monitored and reported, to form the scientific basis for policy. Counter arguments maintain that to do so would be overly consumptive of time, money, and human resources, would provide few, if any, additional benefits, would excessively restrict policymaking discretion, and could further open the area of policymaking to potentially disruptive, overly narrow interests.

COORDINATION AND STANDARDIZATION OF BASIC FEDERAL TOXICOLOGICAL RESEARCH

Issue

In recent sessions of Congress the problem of coordinating and supervising the basic research effort in environmental and occupational toxicology within the Federal Government has not been addressed.

Background

The lack of coordination and communication within the Federal Government in initiating toxicological research has resulted in the development of parallel but independent basic research programs in the environmental and occupational toxicology areas. The independent development of animal models, carcinogen testing methods, exposure tests, toxicity evaluations, and mutagenicity and teratogenicity studies, are examples where duplication has occurred. Duplicative research programs are costly and represent a poor utilization of resources. Individuals and professional organizations have expressed concern over the lack of direction by the Federal Government in the establishment of basic toxicological research responsibilities and a coordinated research strategy.

The National Institutes of Health, through the National Institute of Environmental Health Sciences (NIEHS), has responsibility for the development of new and more efficient test systems and methods. This Institute seems the likely agency to coordinate future basic toxicological research if a decision to coordinate is taken.

Analysis

Opponents to the consolidation of the basic toxicological research programs argue that the individual needs of their agency or service may not be met if the basic research priorities set by the coordinating body do not match the applied research priorities of the particular agency.

Advocates stress the cost savings and efficiency of one Institute conducting, coordinating, and/or supervising the basic toxicological research program.

Available options might include: (1) retention of the current independent programs without coordination; (2) consolidation of all basic Federal toxicological and animal model research under NIEHS; (3) consolidation of all non-military basic toxicological and animal model research under NIEHS and all military research under one joint service organization.

COORDINATION OF FEDERAL CANCER POLICY: RISK ASSESSMENT

Issue

In recent years there has been a lack of coordination among Federal agencies on a consistent cancer policy. Congressional and agency attempts to define such terms as "significant" or "unreasonable" risk in the context of the Toxic Substances Control Act and the Food, Drug, and Cosmetic Act have further confirmed the complexity of this policy area.

Background

The Interagency Regulatory Group (IRLG), defunct since 1981, was a formal arrangement by which such agencies as the Environmental Protection Agency, the Occupational Safety and Health Administration, the Consumer Product Safety Commission, the Food and Drug Administration, the U.S. Department of Agriculture, and the Department of Energy contributed to the international iterative public process to form a consistent cancer policy. The IRLG attempted to develop consistent criteria for determining a substance's risk; the IRLG accepted animal data as valid indicators for judging a compound's effect on humans. According to Perera and Petito (Science, 18 June 1982) the Environmental Protection Agency and the Occupational Safety and Health Administration are decreasing reliance on animal studies as evidence of carcinogenicity in humans. Both of the agencies have reversed decisions to initiate regulatory action to limit exposure to formaldehyde.

The National Academy of Sciences is also conducting a study of the roles of risk assessment in various Federal agencies, a study which may have direct application to Federal cancer policy.

Analysis

As a major public health problem, cancer control would benefit from consistent Federal policy. The acceptable levels of carcinogenic risk set by individual Federal agencies may be inconsistent. Departure from reliance on animal data may also produce inconsistent policies. Congressional and agency concerns focus on how to foster a coordinated Federal cancer policy and how to provide for adequate, on-going review of such a policy. The results of the current National Academy of Sciences Risk Assessment Policy study will hopefully provide useful data for concerned policymakers.

TERATOGENIC EFFECTS OF ENVIRONMENTAL SUBSTANCES

Issue

Congressional interest has focused on the need for Federal coordination of research and regulation of teratogens. Current programs to detect and prevent chemical and physical hazards to reproduction may need to be re-evaluated, and the "acceptable level of risk" factor may need to be considered in terms of public policy decisions.

Background

It is known that exposure to certain chemicals (including both environmental and pharmaceutical substances) and physical factors (such as ionizing radiation) can result in reproductive impairment. Such impairment may be broadly defined to include adverse effects on male and female fertility, as well as genetic or somatic defects in the products of conception (offspring).

Congressional hearings in the 97th Congress highlighted several documented episodes of human teratogenic effects caused by exposure to certain chemical agents (mercury, diethylstilbestrol or DES, and the pesticide dibromochloropropane or DBCP), and emphasized the need to develop the science to improve the ability to identify reproductive hazards in the workplace as well as in the general environment. The general findings of congressional oversight in this area seem to indicate a need for improved coordination among Federal regulatory and research agencies in the area of reproductive hazards as well as more research at all levels (including epidemiological studies, animal testing models, and biochemical analysis).

Analysis

The findings of congressional oversight hearings have highlighted a need for coordination of Federal research and regulatory efforts regarding teratogens. Once a substance is determined to be a teratogen, either through retrospective studies or predictive research and analysis, other ethical and legal issues of public policy arise: Should a woman of reproductive age be prohibited from working in an environment where she might be exposed to teratogenic agents? Should she be allowed or required to sign a waiver for herself and on behalf of her potential offspring freeing her employer from any liability and compensation responsibilities in the event of damage to either of them? Likewise, should male workers who might be exposed to hazardous substances be required to undergo fertility testing prior to chemical exposure? Should monitoring of the workplaces for possible teratogens be routinely required rather than waiting for an incident to occur to prompt such monitoring? How many incidents or reports of adverse effects must occur before regulatory action is triggered?

HEALTH EFFECTS OF PESTICIDES/ENVIRONMENTAL MONITORING, R&D DIRECTIONS, COORDINATION

Issue

Detection and control technologies, the state of physiological and environmental understanding, and the health effects data base are continually being improved and expanded. Policymakers can make full use of these improvements in the effort to improve the responsiveness, equitability, and efficiency of policies. How best to use these advances is at issue.

Background

At issue is the process by which the advances in science are incorporated into policymaking. At one time, acceptable research protocol was developed by scientists, human and environmental health risks were scientifically extrapolated and applicability of these extrapolations was suggested to policymakers, and the entire process was performed in an iterative international public fashion with scientific peer review. Concern is now being expressed that policymaking has become too closely associated with scientific research, resulting in less-than-objective science and regulatory policies at variance across agencies. Seven major issues relating to Federal policies on pesticides can also be considered as more general issues of Federal policy on scientific research and development: a) establishment and maintenance of, and monitoring to insure compliance with, standards for contractor performance regarding the adherence to accepted protocol; b) establishment of a requirement for sound environmental monitoring (translocation, animal and human exposure studies in relation to pesticides); c) coordination of Federal policy regarding the level of risk necessary to trigger regulatory action (the numbers of species, and the numbers and types of studies required); d) a coordinated Federal policy regarding the bases upon which to reevaluate already regulated compounds (here, pesticides); e) the requirement for the revelation of scientific bases of a policy decision, whether the decision is to regulate or not; f) the pursuit of alternative sources of funding, e.g., private sector and foundations; and g) the protection of the objectivity of science. Properly incorporated, scientific advances could contribute to environmental health policies of increased equitability, efficiency, and responsiveness.

Analysis

Environmental health policy has traditionally been arrived at by a public, international iterative process. Arguments have been made that to protect the objectivity of science, scientific analysis should be performed separately from policymaking, the science should be subjected to traditional, open peer-review, and the makers of policy should plainly indicate the scientific bases of their policy decisions whether the decision is to regulate or not. Counter arguments maintain that to do so would be overly resource consumptive (time, money, and personnel), would provide few, if any, additional benefits, would excessively restrict policymaking discretion, and could further open the area of policymaking to potentially disruptive, overly-narrow interests.

HEALTH EFFECTS RESEARCH: FUNDING ALTERNATIVES

Issue

As Federal funding for civilian scientific research decreases science must turn to foundation grants and the private sector for support. One concern raised by interest groups, scientists and Congress regarding alternate sources of funding has been the protection of the objectivity of science.

Background

One example of alternate funding for scientific research is the independent Health Effects Institute (HEI), created by the Environmental Protection Agency and the automotive industry to assess the health effects of auto emissions. In its first year HEI received $3 million from the Environmental Protection Agency and $3 million from the auto companies. HEI's directors include Archibald Cox, former Watergate special prosecutor, Donald Kennedy, former head of the Food and Drug Administration and William Baker, retired chairman of Bell Laboratories.

Another innovative health effects research organization has been proposed by the American Industrial Health Council (AIHC). The AIHC, an industry "think tank", has proposed the creation of a science panel as part of the National Academy of Sciences. Funding for the proposed panel by governmental and non-governmental sources has been discussed.

Analysis

It is essential to protect objective science since policy decisions are based upon it. This aim could become difficult as science becomes supported by non-governmental groups. In the current difficult economic times, however, science must look outside of government for additional funding. One potential benefit of joint funding of health research efforts is the reduction of adversarial relationships between the regulators and the regulated. Cooperative efforts between industry and government can be pursued, while objective science may be protected by requiring open peer review, oversight and monitoring.

HEALTH EFFECTS OF IONIZING AND NON-IONIZING RADIATIONS

Issue

In the 97th Congress, a number of pieces of legislation were introduced that would have: (1) Reorganized the entire Federal radiation health and safety regulatory and research establishment; (2) provided compensation to civilian and military victims of radioactive fallout issuing from open-air nuclear bomb tests conducted in the 1950s and 1960s; and (3) protected the consumer from radioactivity issuing from certain smoke detectors. None of the legislation passed. In addition to the above, hearings were held on the issue of the Department of Energy (DOE) health and mortality study of radiation workers and on the issue of the health and environmental consequences of nuclear warfare.

Background

Public concern over the health hazards of radiation, both ionizing and non-ionizing, has remained at a high level for the past three decades. There has also been an increasing concern about the diffuse and overlapping nature of Federal research and regulatory programs in radiation health and safety. Public concern about radiation hazards has stemmed from a general lack of scientific understanding about the nature of ionizing and non-ionizing radiation hazards; a continuing lack of scientific unanimity about the long-term health effects of low-level radiations; and the fact that radiations are invisible.

The Three-Mile-Island nuclear reactor accident of March 1979 served to heighten public awareness and apprehension about ionizing radiation hazards associated with the nuclear power industries. This apprehension has persisted to date. At the same time, there has continued a concern about the health consequences of diagnostic x-rays; the possible health hazards associated with the use of radioactive materials in consumer products; the long-term health consequences of exposure to radioactive fallout from nuclear bomb tests in the 1950s and 1960s; the potential health and environmental impacts of nuclear warfare; health hazards associated with the disposal of radioactive wastes; and possible adverse health effects of high power voltage lines and radiofrequency and microwave transmitters.

Analysis

The biological and health effects of the ionizing radiations (gamma rays; x-rays; the corpuscular radiations) have been more thoroughly researched than any other physical or chemical factor in human history. Despite that fact, public understanding about the nature and health effects of ionizing radiations remains poor. While the health effects of high levels of ionizing radiations are well understood, scientific opinion remains divided about the long-term health consequences of exposure to low levels of radiation. There is also a diversity of opinion about the health and environmental impacts of nuclear warfare. The scientific uncertainty and public apprehension about low-level ionizing radiation health effects and how to assess those effects in the laboratory or in expensive and time-consuming epidemiological studies can be expected to persist into the foreseeable future.

Likewise, the health effects of the non-ionizing radiations (radiofrequency and microwave radiations; electric and magnetic fields; ultraviolet and infrared radiations; ultrasound) are well understood at high levels of exposure. However, at low levels of exposure scientific opinion about long-term health effects remains divided, particularly with regard to electric fields associated with high-voltage power lines and the radiofrequency and microwave radiations. Therefore, public concern about the health effects of low-level non-ionizing radiations can also be expected to persist in the foreseeable future.

HEALTH AND SOCIAL IMPACTS OF NUCLEAR WARFARE

Issue

In the second session of the 97th Congress, a hearing was held on the health and social consequences of nuclear warfare and the effects of such warfare on the global environment. As the nuclear arms race continues to escalate and relations between the adversary nuclear nations remain tense, the awesome and far-reaching effects on nuclear warfare on the civilizations of the Earth will continue to be the focus of public and Government concern.

Background

Thirty-seven years ago, a nuclear device with a yield of 12,500 tons of TNT was detonated 1,900 feet above the city of Hiroshima, Japan. The health and social impacts of that blast are unprecedented in the history of human warfare. Today, that same device would not equal one-half the destructive potential of the smallest nuclear weapon in the United States inventory. There are a total of 50,000 nuclear weapons in the arsenals of the United States and the Soviet Union.

At international meetings that have been held over the past three decades, the health and social consequences of nuclear warfare have been debated and viewed with common alarm by many international scientific figures representing both the United States and the Soviet Union, since one of the immediate consequences of a nuclear war may be the deaths of millions of people in both countries and the virtually total destruction of entire urban areas. It has remained a matter of considerable debate as to the fate of any survivors of such a war.

Analysis

Officials of both the major adversary nuclear nations believe that contain forms of nuclear war could be prosecuted with tangible spoils available to the victor and that casualties could be minimized to a few tens of thousands of people with proper defensive preparations.

Others, including many scientists and medical doctors in both countries, conclude that the health and social consequences of such a war would be irreversibly disastrous for both adversaries. The preamble of the Resolution on Nuclear War and Arms Control that was passed unanimously by the National Academy of Sciences in 1981 stated simply that: (1) Nuclear war is an unprecedented threat to humanity; (2) A general nuclear war could kill hundreds of millions and destroy civilization as we know it; (3) Any use of nuclear weapons, including use in so-called "limited" areas would very likely escalate to general nuclear war; and (4) Science offers no prospect of effective defense against nuclear war and mutual destruction.

V. ENERGY: ADVANCED AND OTHER ENERGY R&D

BUDGET CUTS IN FEDERAL NONNUCLEAR ENERGY PROGRAMS: IMPLICATIONS FOR PROGRAMS AND PRIORITIES

Issue

The Reagan Administration has imposed massive budget cuts in nonnuclear energy R&D, ending funding parity with nuclear programs. The effects of the budget cuts and resulting policy shifts in nonnuclear energy are beginning to be felt by the private sector. At issue is whether the Administration is moving too fast or has gone too far in its efforts to shift nonnuclear R&D to the private sector. An even broader issue is whether the loss of funding parity between nuclear and nonnuclear programs is in the best national interest.

Background

Federal funding of nonnuclear energy R&D totalled $2.29 billion in FY 1981 when the Reagan Administration took office; funding for nuclear programs totalled $1.89 billion. In FY 1983 the Administration proposed a nonnuclear budget of just $376 million, 84 percent below the FY 1981 level, while proposing a nuclear budget of $1.46 billion, 23 percent below FY 1981.

Nonnuclear R&D programs provide support to the private sector for developing new technologies using fossil fuels, solar and geothermal energy; for energy conservation research; for developing new methods of electricity transmission and energy storage; and for supporting energy-related health and environmental effects research. Cuts in the nonnuclear budget have shifted program focus to high-risk, long-range R&D and eliminated many commercialization, consumer information, economic incentive, and technology demonstration projects. The nonnuclear budget cuts are consistent with the Administration's goal of reducing Federal expenditures and bureaucracy in areas where the private sector can take over. The Administration contends that continued support of a large array of ventures that could not survive the test of the market without subsidies would deplete financial resources without compensating national gain. The Administration justifies the continued high level of Federal support for nuclear technologies as appropriate in light of their potential payoff to the Nation and the inability of industry to make significant investments at this time.

Analysis

There seems to be little question that a reduced Federal program will mean an overall slowdown in new developments and commercial progress in nonnuclear energy technology, due to reduced R&D in both the Federal and private sectors, loss of some Federal support programs, possible loss of some foreign markets and a possible reduction in small business involvement.

R&D Loss. Fewer Federal dollars for nonnuclear energy development will mean that the Federal R&D effort will not be as diverse. This, coupled with the likelihood that the private sector will forego marginal R&D projects, translates into fewer opportunities for technological advancement. This, in turn, can increases the risk of early private commitment to less than optimal systems which could fail in the marketplace.

Support Program Loss. Given the present economic and energy situations, it is becoming increasingly apparent that the nonnuclear industries will not be able to conduct the same aggressive, broad-based R&D and commercialization effort that was carried out in the Federal program. Certain elements of the Federal program will be lost. Among these will be such support elements as information dissemination, hardware demonstrations and technology transfer efforts, which support the industry as a whole but are not of sufficient benefit to any one industry or interest to warrant private investment.

Foreign Markets. Reductions in nonnuclear budgets might also have adverse impacts on U.S. leadership in world markets for nonnuclear technologies. The United States currently holds narrow technical and market leads in some of these markets, but competition from abroad threatens to close the gap.

Less Small Business Involvement. Another consequence of cuts in the nonnuclear budget may be that small businesses will be forced out of energy industries. Small businesses appear particularly vulnerable since they generally do not have the access to capital that large firms have, and are generally more reliant on Federal programs for research funds.

MANPOWER CUTS IN CONSERVATION AND RENEWABLE ENERGY PROGRAMS

Issue

As part of its efforts to control Federal spending, the Reagan Administration has decided to make very large cutbacks in funding with accompanying reductions in force (RIF) for conservation and renewable energy efforts. The total number of staff positions in these programs was reduced from 671 in July 1981 to 337 on October 1, 1982, primarily through RIFs. The Administration's proposed 85% reduction in the FY83 Conservation and Renewable Energy budget would reduce manpower levels even further. Concerns have been raised that staffing levels in these programs have dropped low enough to jeopardize the performance of congressionally mandated activities and that proposals for further reductions are increasing attrition and intensifying existing problems of program management.

Background

In the FY82 Supplemental Appropriations bill (P.L. 97-257), Congress demonstrated its concern over manpower cuts by requiring that DOE maintain a minimum of 352 full-time conservation employees which includes a minimum of 154 R&D employees. This means that there are currently 15 vacancies to be filled. Additionally, the Continuing Appropriations bill for FY83 (P.L. 97-276) restrains the Administration from initiating any RIFs of renewable energy employees. However, it does not compel replacement if attrition drives the employment level below the 160 present on October 1, 1982. DOE reports that it considers the floor on conservation manpower and the constraint on renewable energy RIFs binding. Nevertheless, the constraints of renewable energy RIFs contained in the Continuing Resolution are binding only until an FY83 energy appropriation or another continuing resolution is enacted into law.

Analysis

Supporters of the Conservation and Renewable Energy Programs argue that the staffing changes have already affected the abilities of these programs to manage their activities adequately. They suggest that major problems include (1) the loss of continuity and expertise in top management and staff and (2) continuing uncertainty as to the future of the programs, resulting in high attrition rates and inability to fill vacancies. These problems are especially acute in offices with professional engineers and scientists. The technical requirements of many of these vacancies, together with the mandated exclusion of external applicants, suggests that these positions are not likely to be filled. Additionally, it is argued that efficient program operation can be restored only by eliminating the instability and uncertainty of future staffing and funding levels.

Supporters of continued conservation and renewable energy budget cuts and staff reductions argue that these offices are functioning well despite the staffing reductions. Additionally it is argued that decontrolled oil and natural gas prices will provide sufficient incentive for the private sector marketplace to pick up all but the long-term, high-risk research. Thus, there is very little funding or technical manpower needed in conservation and renewable energy programs. In fact, they claim that continued support for most of these program activities creates an unnecessary drain on scarce Federal resources and contributes to the Federal deficit.

UNITED STATES SYNTHETIC FUELS CORPORATION: ITS EFFECTIVENESS, EFFICIENCY, AND FUTURE

Issue

Title I of the Energy Security Act (P.L. 96-294) created the United States Synthetic Fuels Corporation (SFC) to accelerate the commercialization of an environmentally acceptable and economically feasible synfuels industry at the least cost to the taxpayer. At issue is whether SFC is conducting its program in an effective and efficient manner and whether the purposes of the P.L. 96-294 are likely to be achieved. Congress will also have to decide the amount, if any, of future funding for the Corporation.

Background

SFC is a major cornerstone of our National Synfuels Policy. P.L. 96-294 directs SFC to help achieve the National Synfuels Production Goals of reaching a daily synfuels production capacity of .5 million barrels of oil equivalent by 1987 and 2.0 million barrels per day by 1992. Thus far, SFC has issued three solicitations requesting private sponsors to submit proposals seeking financial assistance. The Corporation is reviewing project applications and negotiating the terms and conditions of financial assistance with other project sponsors. Although there is substantial evidence that SFC is seeking to implement efficiently its responsibilities under P.L. 96-294, it is unlikely that the Corporation will be able to carry out effectively many of the objectives of this law. From current status, in fact, if a daily synfuels production level of 30,000 to 60,000 barrels of oil equivalent is reached by 1987, industry and SFC would have achieved a major technological and economic accomplishment.

Analysis

Both Congress and the Administration are currently assessing SFC's operations, policies, and future prospects. Some of the options being considered include: (1) abolish the Corporation, (2) extend SFC's authority to include the support of biomass fuels projects and energy-from-solid waste plants, and (3) limit SFC's appropriations to the $14.9 billion provided by existing law, or (4) provide additional appropriations beyond this amount. Before deciding the future of the Corporation, it may be useful to review the current prospects for the synfuels industry and consider the relationships among SFC and other Federal activities, such as the Environmental Protection Agency's (EPA) regulatory practices affecting synfuels production as well as EPA's research on the impacts of commercialization.

Many of SFC's supporters are concerned that the Corporation has not yet moved its program forward expeditiously and they seek more vigorous efforts to provide financial assistance soon to a variety of project sponsors. SFC's opponents have questioned the continued need for the Corporation, have maintained that industry is not yet ready to build a successful commercial plant, or have proposed using funds appropriated to SFC for other budgetary purposes, such as to provide housing or employment subsidies. The Reagan Administration has stated that it does not intend to provide any additional appropriations to SFC.

PACE AND THRUST OF FEDERAL ROLE IN ELECTRIC ENERGY SYSTEMS AND ENERGY STORAGE

Issue

The Reagan Administration's Economic Recovery Program has emphasized budget cutbacks along with a redirection of alternative energy programs. Funding for Electric Energy Systems and Energy Storage was reduced by 60 percent from FY81 to FY82. In FY83, the Administration requested that these programs be terminated. Concerns have been raised that significant contributions to fuel switching and oil import reductions may be lost because there are insufficient incentives for the private sector to pick up the activities that have been conducted by these programs.

Background

During the 1970s, the Federal Government steadily increased its support for electric energy systems and energy storage R&D. The rationale for support of these programs was derived primarily from a search for domestic alternatives to increasing foreign oil dependence. Now, however, the Reagan Administration is arguing that decontrol of oil prices provides sufficient incentives for private sector development, demonstration and commercialization of these technologies.

Consequently, as part of its efforts to control Federal spending, the Administration has requested that Congress terminate funding for these programs. It believes that a small role in basic research on electrochemical systems is warranted, but should be made part of the multi-sector activities of conservation research. All other electric energy and storage developments are seen as sufficiently advanced for the private sector to pursue them if they show commercial promise. In particular, the Administration argues that: (1) electric energy systems projects are no longer appropriate for Federal support, (2) barriers to commercialization of thermal and chemical storage are low, and (3) utilities have the financial capability to stimulate further development of battery storage systems.

Supporters of the Electric Energy Systems and Energy Storage Programs argue that it is in the national interest to develop these technologies since they can help reduce oil dependence, improve the balance of trade, increase utility systems reliability, reduce environmental impact, and lower consumer energy costs. They point out that private sector investments in R&D are discouraged by the uncertainty of technical success, weakness of the market, and long development times required. Additionally, utilities are generally restrained by State public utility commissions from recovering R&D expenses.

Those who support the termination of electric energy systems and energy storage R&D argue that the Federal Government's role should be restricted to only the highest risk, longest-range research efforts which would not be conducted by the private sector. All such innovation must sooner or later

pass the test of the market. Furthermore, they assert that utilities, the Electric Power Research Institute, utility equipment manufacturers and universities will continue to build on the work that has been sponsored by these programs. The cost-shared contracts that have been in effect are seen as seed money for projects that will continue under private sector guidance. Additionally, the Economic Recovery Tax Act is seen to provide sufficient incentive to stimulate this type of continuity of effort.

Analysis

It appears that market conditions and energy price increases may provide insufficient incentive to utilities and other elements of the private sector which lack the financial resources and incentives to pick up work that has already been deleted from these programs. Meanwhile, foreign competition in the development of these technologies is seen to be emerging rapidly. Additionally, the threat of termination is affecting program staff morale and causing technical personnel to seek more secure employment elsewhere.

BASIC AND APPLIED RESEARCH IN CRITICAL ENERGY-RELATED AREAS

Issue

The Reagan Administration has substantially reduced Federal funding for basic and applied research in some critical energy-related areas and increased funding in other areas. At issue is whether DOE is supporting the comprehensive and balanced basic and applied research programs that would help establish a sound foundation for advances in improved and future energy technologies.

Background

DOE conducts and supports numerous research programs aimed at extending the fundamental scientific and engineering knowledge base in critical energy-related areas. DOE's Office of Basic Energy Sciences, Office of Fossil Energy, and Office of Energy Research are among the principal organizational entities that participate in these programs. Through these efforts, a better understanding is sought of the fundamental physical, chemical, and nuclear phenomena that hopefully will yield advances and provide breakthroughs in future energy technologies. These activities typically address broad basic and technological problems applicable to many facets of energy research and development. Important areas of continuing interest include: fundamental research in coal chemistry, structure, combustion, and utilization; improved understanding of heat transfer and fluid flow mechanisms; applied research in engineering analysis, mathematical modeling, and environmental assessment and compliance.

It appears that the Reagan Administration is shifting funds for basic and applied research away from specific program areas, such as fossil energy, to more generic programs within DOE. For example, for DOE's FY83 advanced research and technology development program, (which is part of the fossil energy program), the Reagan Administration proposed a decrease in budget authority to $19.8 million from a FY82 appropriation of $56.26 million. However, the Administration proposed an increase in budget authority for DOE's FY83 Basic Sciences category of its General Sciences and Research program to $600.970 million from a FY82 appropriation of $547.702 million.

Analysis

Oversight and authorizing hearings on the various DOE programs concerning critical energy-related areas could consider: (1) whether DOE is achieving a sound balance among the various programs supporting basic and applied research in these areas, (2) whether DOE is maintaining the proper momentum, stability, and research environment to move these programs forward in an expeditious manner, and (3) whether DOE's organizational plans and policies are adversely affecting work conducted at the National Laboratories and energy technology centers in critical energy-related areas.

VI. ENERGY: NUCLEAR ENERGY R&D

THE PACE AND DIRECTION OF LIQUID METAL FAST BREEDER REACTOR (LMFBR) DEVELOPMENT

Issue

Breeder reactors have been under development in the United States since the 1940s. Development of a liquid metal fast breeder reactor (LMFBR) was identified as the major objective of the U.S. nuclear reactor program in 1967, and over $6 billion has been spent on LMFBRs since that time. However, breeder reactors remain controversial. At issue is the overall pace and direction of LMFBR development and particularly whether to continue to build the Clinch River Breeder Reactor (CRBR) now under construction near Oak Ridge, Tennessee.

Background

Breeder reactors could produce about 60 times as much energy per pound of uranium mined as the light water reactors (LWRs) currently in use. However, there is concern that development of LMFBRs could contribute to the proliferation of nuclear weapons, because of the plutonium they produce.

The major focus of the LMFBR development program is the Clinch River Breeder Reactor (CRBR), which is a 350 MWe demonstration plant first authorized by Congress in 1970. CRBR originally was to begin operation in 1982, but the Carter Administration opposed the project and prevented the start of construction at the site. With Reagan Administration support, construction was allowed to begin in September 1982, but the plant is not scheduled for completion until 1989. About $1.4 billion has been spent on CRBR. The Department of Energy estimates that the total cost of the plant will be $3.6 billion, but other estimates go as high as $8-10 billion. The project has survived several close votes in Congress during the past two years on amendments to appropriations bills that would have deleted all funding for CRBR.

CRBR is designed to demonstrate LMFBR technology, but it is not large enough to show whether LMFBRs can be operated economically. At least one additional demonstration plant will most likely be required before the commercial feasibility of LMFBRs can be proved.

Analysis

In addition to proliferation concerns, CRBR opponents claim that it should not be built, because it is too costly and its design is obsolete. Opponents of rapid breeder development also note that when CRBR was first authorized it appeared that breeder reactors would be needed before the year 2000 to prevent exhaustion of uranium resources, but since then the growth of nuclear power has slowed considerably and additional uranium has been discovered. They claim that breeders will not now be economically competitive until beyond 2020.

CRBR supporters claim that its design has been updated, making it the most modern breeder reactor design in the world. Proponents of rapid breeder development note that if electricity use grows faster than currently anticipated or environmental problems limit the use of coal for electricity generation, then breeders could be needed before 2020. In their view breeder development should proceed rapidly as insurance against possible uranium shortages that could lead to electricity shortages.

THE FUTURE OF THE BARNWELL REPROCESSING PLANT

Issue

The Reagan Administration is attempting to encourage private interests to complete and operate a plant for the reprocessing of spent nuclear reactor fuel that is partially finished, but lying idle, near Barnwell, South Carolina. At issue is Congressional approval of possible incentives that the Administration may wish to offer private interests to complete and operate the plant.

Background

A partially completed plant for the reprocessing of spent nuclear reactor fuel has sat idle near Barnwell, South Carolina, since President Carter banned reprocessing in the United States in 1977 over concerns about nuclear weapons proliferation. The Reagan Administration supports reprocessing and has encouraged private concerns to complete and operate the plant. Thus far, the Administration's efforts have been unsuccessful because of fears on the part of potential investors that government policy may again change and the plant will not be able to operate, and also because the current low price of uranium and uncertain market for the sale of plutonium has made the economics of reprocessing and commercial use of plutonium fuel questionable.

There have been reports that the Administration may offer to guarantee the plant against changing government policies and/or contract to buy a substantial amount of the plutonium produced during the first few years of operation. Congress may have to approve any possible incentive plan to complete the Barnwell plant; and would have to appropriate funds for it.

Analysis

Arguments in favor of Government incentives to complete Barnwell include: 1.) Barnwell is a valuable resource that will be lost if it is not completed; 2.) Reprocessing recovers the large amount of energy value in the uranium and plutonium of spent fuel and leaves the wastes in a perferred form for permanent disposal; and 3.) The plutonium that can be recovered at Barnwell is needed for the U.S. breeder reactor development program and might not be readily available from other sources.

Arguments against Government incentives to complete Barnwell include: 1.) Reprocessing is uneconomic; 2.) Reprocessing may contribute to the proliferation of nuclear weapons; and 3.) Support for Barnwell would be a needless subsidy to the nuclear industry.

Congress might consider other options for the use of the Barnwell plant including, its operation as a spent fuel storage facility, and for research and development on safeguards for the plutonium recovered during reprocessing.

There have been suggestions that foreign concerns might be interested in participating in possible uses of the plant. Foreign participation could supply needed capital, and might improve the U.S. position as a leader in world nuclear technology and further the nation's nonproliferation objectives. However, there is concern that foreign participation could be counter to U.S. nonproliferation objectives because it would involve the transfer of sensitive technology.

THE PACE AND DIRECTION OF THE MAGNETIC FUSION PROGRAM

Issue

Fusion is a potential source of energy that relies on low-cost, readily available, inexhaustible fuels and may pose fewer environmental and safety problems than current electric power plants. However, the technical and economic feasibility of fusion power has not been demonstrated, and fusion could not contribute to U.S. energy supplies for many years. Congress has the option to choose between further development stategies that differ in cost, risk, and the projected date for commercial demonstration of fusion.

Background

Commercial demonstration of fusion can be thought of as a three stage process. 1. Demonstrate production of energy through controlled fusion (scientific feasibility); 2. Demonstrate production of energy under conditions similar to utility needs (engineering feasibility); and 3. Demonstrate that fusion plants are practicable for commercial use and can be economic compared to alternative sources (commercial demonstration). Experimental fusion devices scheduled to begin operation in the next few years are expected to demonstrate scientific feasibility.

In anticipation of this result, Congress passed the Magnetic Fusion Energy Engineering Act of 1980, P.L. 96-386, which established the goal of demonstrating the engineering feasibility of fusion by the early 1990s. The 1980 Act called for the operation of a Fusion Engineering Device (FED) by 1990 and a magnetic fusion demonstration plant (DEMO) by the year 2000. The Act found that the program would require an increase in funding for magnetic fusion of 25% in real terms in each of ficsal years 1982 and 1983 and a doubling of funding within 7 years, from the FY81 base of $394 million. However, it did not authorize actual spending levels.

The ambitious development program called for in the 1980 Fusion Act has not been realized. Funding for magnetic fusion has remained constant in real terms, construction schedules for major projects have been stretched out, other projects are threatened with cancellation, and work on the FED called for in the Act has not been initiated.

Analysis

Instead of the strategy based on an FED in operation by 1990, DOE's current strategy, which anticipates near level funding through FY88, relies heavily on use of existing facilities. In that strategy, a decision would be made in 1988 to proceed with an Engineering Test Reactor (ETR), which would be a more advanced machine than the FED. The ETR might take the place of both the FED and DEMO and allow for commercialization shortly after 2000.

The current DOE strategy is less costly in the short run, but involves more risk than the FED based strategy. The DOE strategy calls for an earlier choice between competing magnetic fusion techniques and compresses the time between engineering development and commercial demonstration.

URANIUM ENRICHMENT TECHNOLOGY DEVELOPMENT

Issue

The Department of Energy is supporting development of two different technologies that offer large potential improvements over current uranium enrichment techniques. They are advanced centrifuges and laser isotope separation. At issue is the strategy and pace of development of these technologies. A broader issue is how the potential for new technologies affects the the need for and economics of the gas centrifuge enrichment plant now under construction.

Background

Enrichment is a necessary step in preparing uranium for use as nuclear reactor fuel for most, but not all, reactors. The Department of Energy (DOE) supplies uranium enrichment services to commercial users on a cost recovery basis from plants that were built in the 1940s and 1950s. Enrichment is about a $2 billion a year activity for DOE. The existing plants use a process called diffusion that requires large amounts of electric power. The electric bill for the diffusion plants for FY83 is projected to be about $900 million.

DOE is currently building a new $7 billion enrichment plant to meet future demand and to replace some of the production from its old diffusion plants. The new plant will use a centrifuge process that requires only 5% as much electricity as diffusion. The plant, called the Gas Centrifuge Enrichment Plant (GCEP), is scheduled for partial operation in 1989 and full operation in 1994.

For long term enrichment needs, DOE is developing advanced centrifuges that could be retrofit into GCEP with the goal of doubling enrichment output without increasing cost by 1998. DOE is also developing a technique called laser isotope separation (LIS) that has the goal of reducing enrichment costs by about 2/3. While LIS appears quite promising, it is at an earlier stage of development than centrifuge technology. Advanced centrifuges are an extrapolation from current centrifuge technology, but LIS is as yet untested on a large scale.

Analysis

DOE plans to begin design of an LIS demonstration in FY 1984 and continue development of both advanced centrifuges and LIS until the early 1990s, when a decision on which technology to use for future capacity is to be made. However, proponents of LIS believe that a demonstration should be built sooner and that it could be possible to build full scale production units for operation by the mid-1990s.

The schedule of LIS and advanced centrifuge development is of particular concern, because it may be desirable to cancel or defer construction of all or part of the GCEP plant if LIS technology superior to the centrifuges to be installed in GCEP could be available by the mid-1990s.

THE POTENTIAL FOR NEW TECHNOLOGIES TO REVIVE THE NUCLEAR POWER INDUSTRY

Issue

No new nuclear power plants have been ordered in the United States since 1978, and numerous plants ordered previously have been cancelled. The depression in the nuclear industry is largely due to reduced growth in demand for electricity, but shortcomings with the light water reactor (LWR) technology currently in use may have contributed to the depression as well. At issue is Government support for new nuclear reactor technologies that might help revive the nuclear power industry.

Background

Several advances in nuclear reactor technology that are near to commercial application might help to improve the outlook for nuclear power. The near term technologies include improved light water reactors, high temperature gas reactors (HTGRs), and small reactors.

1.) Light water reactor improvements include measures that could increase the amount of electricity that can be generated from a given amount of fuel by 15-30% and changes in construction practices that could reduce the time it takes to build a power plant.

2.) High temperature gas reactors might have safety advantages compared to LWRs and also economic advantages in water short regions of the country. In addition, HTGRs could be used to supply process heat for industrial purposes.

3.) Small reactors could be constructed in less time than large reactors, would fit more easily into the load growth pattern of most utilities, would require less capital to build than large reactors, and might have safety advantages.

Of course each of these technologies may have economic or other disadvantages that could outweigh their potential benefits.

Analysis

Utilities claim that they do not have the capital to risk in demonstrating new technologies and would like Federal assistance. However, the Reagan Administration is opposed to funding demonstrations of near term technologies, which it believes should be demonstrated by the private sector.

Comparatively little Federal money is being spent on these three potential near term nuclear technologies. There is no Government program for development of small reactors, and the Reagan Administration has tried to cancel DOE's HTGR program and cut the LWR fuel improvements program substantially. However, it appears that both programs will be funded at about the same levels in FY83 as in FY82--$40 million for HTGRs and $11 million for LWR fuel utilization improvements.

The questions to be answered in determining whether Federal funds should be used to help demonstrate these technologies include the technical question of whether the new technologies offer significant advantages over current technologies and the philosophical question of whether it is appropriate for the Federal Government to assist in commercializing near term technologies.

THE POTENTIAL IMPACT OF NUCLEAR LICENSING REFORM ON CONSTRUCTION TIME AND THE ECONOMICS OF NUCLEAR POWER

Issue

Nuclear power plant construction times have doubled in the past ten years. At issue is how much construction time could be reduced through reform of the licensing process for nuclear power plants and how a reduction in construction time could affect the economics of nuclear power.

Background

The time between the initial order for a nuclear power plant and the start of operation has increased from about 6-8 years in the early 1970s to about 12 years today. Reasons for the increase include: increases in the size and complexity of nuclear plants, difficulty in obtaining financing, scheduled delays due to reduced electricity demand growth, and more stringent licensing and regulatory requirements.

It may be possible to reduce substantially the lead time needed to bring a nuclear plant into operation through changes in the NRC's licensing process. Since about 40% of the cost of building a nuclear plant is interest during construction, large savings could result from a reduction in the lead time.

Suggestions for reducing lead times through licensing reform include: early site approval, preapproval of plant designs, and reduced backfitting requirements. Early site approval would allow a utility to have a site approved before a decision was made to build a particular plant; preapproval of plant designs would authorize the Nuclear Regulatory Commission (NRC) to approve standard nuclear plant designs or major subsystems; and reduced backfitting requirements would allow the NRC to require changes in plant designs after approval of a construction permit only if it determined that a plant did not meet minimum safety standards. A recent DOE study found that those three changes could reduce lead times by 5.5 years and cut capital costs by 28%. Additional licensing reforms have been proposed by both DOE and the NRC, but the three discussed above are projected to have the largest impact on plant lead times.

Analysis

Since much of the increase in nuclear plant lead times is not connected to regulatory changes, but rather to other causes listed above, it is questionable whether the 5.5 years claimed by the DOE study could be saved. Nevertheless, the savings is no doubt substantial.

In addition to the savings in time and money, standardization of plant designs might enhance safety by increasing the possibilities for sharing of experience at similar plants. On the other hand, there could be adverse safety consequences from the proposed reforms: Standardization could slow the introduction of changes that might improve safety; early site approval might allow plants to be built on sites that had large population growth between the time of site approval and plant constuction; and reduced backfitting requirements could be seen as a relaxation of the principle that risks should be as low as reasonably achievable (ALARA principle).

OVERSIGHT OF NUCLEAR SAFETY RESEARCH

Issue

Nearly half of the Nuclear Regulatory Commission's budget is spent on safety research. However, there has been criticism that the research performed by the NRC does not contribute effectively to the agency's mission. Congress has shown a continuing interest in: the determination of safety research priorities; the procedure by which NRC research results are incorporated into agency rules and regulations; and the relationship between the NRC and other institutions performing nuclear safety research.

Background

Prior to 1977, the NRC was statutorily limited to performing "confirmatory research", which it interpreted as research needed to provide a basis for regulatory decisions. An amendment to The Energy Reorganization Act, approved in December 1977 (P.L. 95-209), expanded the scope of NRC research to include the development of new or improved safety systems for nuclear power plants.

The Department of Energy performs some light water reactor safety research. Reactor manufacturers and the utility industy also support research in nuclear safety. However, the NRC research program is considerably larger than all other nuclear safety efforts combined. The research safety budget for the NRC for FY82 was about $200 million.

Analysis

It is not clear whether the NRC has expanded the scope of its research in accordance with the broader mandate it received in 1977. Much NRC research is still designed to verify calculations and computer codes that predict the ability of nuclear reactors to respond to various situations. There is a perception that the results of this research do not lead to changes in regulations, particularly in those cases in which the results show the regulations to be based on conservative assumptions.

Additional criticism has been directed at the way in which the NRC determines its research priorities. The NRC prepares both an annual and five-year research plan, but the House Science and Technology Committee has found that "The setting of research priorities at the NRC is an ad-hoc process, with no overall framework or systems overview and very little delineation of potential costs and benefits for individual programs."

In order to improve the effectiveness of NRC safety research, Congress might encourage the NRC to coordinate its research programs more closely with its regulation and standards setting functions. In addition, some observers believe that NRC research might be more cost-effective if there were increased coordination between the NRC and the other institutions that perform reactor research. However, others believe that working too closely with promoters of nuclear power might compromise the independence of the NRC.

FEDERAL AND PRIVATE ROLES IN NUCLEAR FUEL CYCLE SERVICES

Issue

A few stages of the nuclear fuel cycle have traditionally been under Federal control, while most others are in private hands. At issue are changes in the Federal and private roles for three fuel cycle services—enrichment, reprocessing, and waste disposal. Proposals include privatization of currently Government operated services, hybrid Government/private structures, modified management and financing structures within Government control, and Government guarantees for private ventures.

Background

The Atomic Energy Act of 1954 provided for private ownership of nuclear facilities that previously could be owned only by the Government. Since that act was passed, some elements of the nuclear fuel cycle, most notably the power generation stage, have grown as private ventures while other have remained under Federal ownership. Changes in ownership or management structure are now being considered for the uranium enrichment, spent fuel reprocessing, and waste disposal stages of the fuel cycle.

Uranium is enriched for use as nuclear fuel in Government owned plants that were originally built to meet defense needs. An effort to privatize enrichment in the early 1970s failed, and the Department of Energy is currently building a new $7 billion enrichment plant.

Three privately funded reprocessing plants built in the United States have all been financial failures and are not now operational. The Reagan Administration has tried (so far unsuccessfully) to encourage private concerns to bring one of those plants, at Barnwell, South Carolina, into operation.

High level radioactive waste disposal has traditionally been viewed as a Federal function. R & D has been supported by the Federal Government, but a 1 mill/kw-hr fee to be assessed on nuclear generated electricity has been proposed to fund waste disposal.

Analysis

Several alternative structures may be considered for the above fuel cycle activities. New institutions may encompass two or three of the activities together, or any one of them individually.

Some facilities now belonging to the Government could be transferred to one or more private corporations operated on a for-profit basis or to nonprofit cooperatives formed by nuclear utilities. Financial incentives or Government guarantees might be required for privatization. Hybrid structures could be established by contract as joint ventures between government and private participants, or a government corporation on the lines of the Tennessee Valley Administration could be established. If under direct Government control, selected fuel cycle activities could be funded by annual appropriations or by a revolving fund consisting of revenues from the sale of services, fees imposed on electricity sales, appropriations, and/or revenue from the sale of bonds. Government control could be within an existing agency, or within a separate directorate or authority established with the desired level of independence.

REPROCESSING AND THE AVAILABILITY OF PLUTONIUM FOR BREEDER REACTOR DEVELOPMENT

Issue

The Department of Energy expects to need about 7 (short) tons of plutonium to fuel the Clinch River Breeder Reactor for the first 5 years of its operation. At issue is whether this quantity of plutonium will be available when it is needed.

Background

The Department of Energy (DOE) currently needs about one-half ton of plutonium a year to fuel operating breeder reactor projects. Plutonium requirements will increase to about 2 tons per year by 1989, if the Clinch River Breeder Reactor (CRBR) goes into operation on schedule. The source for this plutonium is uncertain.

The only existing domestic source of plutonium is the U.S. defense program. DOE's Office of [Defense] Nuclear Materials Production has traditionally provided plutonium, at no charge, to DOE's breeder program. That office has made commitments to supply plutonium for the first core and several reloads for CRBR. However, according to the General Accounting Office (EMD-82-128), DOE officials have stated that "this Nation's defense needs could impact on their capability to supply the necessary plutonium."

Another potential source of plutonium is the Barnwell reprocessing plant. The Barnwell plant is a partially completed facility designed to reprocess 1500 tons of spent nuclear fuel per year. However, its owners have decided not to complete the facility and bring it into operation. The Reagan Administration is trying to persuade private interests to complete and operate Barnwell, which could separate 5-10 tons of plutonium per year from commercial spent nuclear fuel. As an inducement to private reprocessing, the Administration may propose guaranteeing to purchase some or all of the plutonium produced in up to the first 5 years of operation.

Analysis

A purchase guarantee for Barnwell could assure a supply of the plutonium needed for CRBR, assuming that the plant could be completed, licensed, and brought into operation by 1988. Without the Barnwell plant, the domestic supply of plutonium sufficient to fuel CRBR may be uncertain. The current source of supply is subject to U.S. defense needs. In addition, defense program supply of plutonium for breeder programs is predicated on the assumption that the plutonium produced in the breeders will be returned for use in the defense program. However, use of plutonium from civilian power reactors for weapons may be prohibited by the FY82-FY83 Nuclear Regulatory Commission Authorization bill (H.R. 2330).

On the other hand, CRBR plutonium needs are small compared to defense needs, and sufficient plutonium is very likely to be available for CRBR from the defense program. In addition, it has been reported that 10-12 tons of plutonium in the United Kingdom could be available for sale to the U.S. breeder programs. Furthermore, 1 year's worth of production from Barnwell should be sufficient to supply enough plutonium for CRBR operation for 5 years.

STATUS OF FOREIGN NUCLEAR TECHNOLOGY PROGRAMS

Issue

The general worldwide slowdown in the development of nuclear power has had various impacts in different countries. At issue is an understanding of the status of foreign nuclear technology programs and their impact on: competition with U.S. suppliers of nuclear materials, equipment and technology; possibilities for international cooperation in development of new technology; nuclear weapons proliferation; and choices among fuel cycle options.

Background

At one time the United States was virtually the sole international supplier of nuclear materials, equipment and technology. Now there is stiff competition for reactor and equipment sales from France, West Germany, Britain, Sweden, Canada and others. Competition is heightened because the market for new power reactors has slackened in the past few years due to reduced expectations worldwide for nuclear growth.

The U.S. share of the uranium enrichment market has gone from 100% in the late 1970s to 35% today. There is a worldwide glut of enrichment capacity, with competition for enrichment sales from plants in several European countries and new enrichment plants planned in Japan and Australia.

In the development of new technology, the United States may now lag behind other countries in several areas. France is the world leader in breeder reactor development, with a full scale breeder reactor scheduled for operation next year. The Soviet Union has demonstration breeders working and is proceeding towards a full scale breeder. High temperature gas reactor development is proceeding more rapidly in Japan and West Germany than in the United States where it originated. And in some areas of fusion research the European community is ahead of the United States. Britain and France have reprocessing plants in operation and new reprocessing plants are being built in France, West Germany, and Japan. In addition, several foreign countries are proceeding with experimental use of reprocessed mixed oxide fuel in light water reactors, while the United States is not now using that technology.

Analysis

It appears that the United States cannot maintain the dominance that it once enjoyed in the international nuclear marketplace. Several questions may be asked. How should U.S. nuclear technology development proceed so that we will best be able to compete with foreign technology? Should more vigorous efforts be made to cooperate with other countries in technology development; particularly in the a areas of breeder reactors, high temperature gas reactors, reprocessing, and fusion? Should we try to compete in all areas of technology development, or can we rely on some imported technology? Will the United States be able to exert its influence in the development of a non-proliferation regime if it is out of step with the rest of the world on the use of reprocessing and mixed oxide fuel?

LINKAGE OF DOMESTIC NUCLEAR POWER AND PROLIFERATION

Issue

Perception of a linkage between nuclear power and nuclear weapons underlies much of the controversy over nuclear power, particularly the development and use of breeder reactors with the attendant commercial production and use of plutonium to expand nuclear weapons production from commercial spent fuel; second, that foreign as well as domestic nuclear power plants may be fueled with plutonium if ongoing R&D here and abroad is successful.

Background

Ever since 1945 and 1956, it has been apparent that many of the materials, equipment and facilities to manufacture nuclear fuel for nuclear power plants could also be used to make materials for nuclear weapons. This linkage underlies much of the opposition to nuclear power, particularly to the breeder, from some public groups and some Members of Congress. The Senate debate on the Humphrey amendment to delete funds for the breeder from the continuing appropriations resolution for FY 1983 (H. J. Res. 599) on September 29 made this abundantly clear; so did Congressional reaction to suspicions that the Administration intended to use plutonium from commercial spent fuel for production of nuclear weapons, which culminated in an amendment to the NRC authorization for FY 1983 prohibiting such use. The linkage appears strongest for civil nuclear power fueled by highly enriched uranium (HEU) or plutonium because, in principle, these materials are the closest to weapons grade. There is little present prospect for use of HEU as a commercial nuclear fuel. However, ongoing U.S. and foreign development of the breeder implies future commercial production and use of plutonium as fuel with the attendant risks that it might be diverted by non-weapons states to make nuclear weapons.

Analysis

Aside from seeking a worldwide shutdown of all nuclear power activities, complete nuclear disarmament, and disposal of all nuclear materials in a way to prevent their reclamation, (which on the whole appears unlikely to occur), there are alternatives, which in principle could keep domestic nuclear power separated from nuclear weapons. The United States could:

(1) Complete the separation of its civil nuclear power from military applications by separating DOE operation of enrichment facilities which now supply both civil and military needs.

(2) Defer further development of new technologies, such as laser isotope separation, which would make it easier to upgrade nuclear materials from civil nuclear power grade to weapons quality.

(3) Defer further development of nuclear power technologies such as breeders which would involve use of plutonium in separated form.

(6.11 continued)

(4) Reexamine the usability of low grade plutonium from nuclear power reactors for manufacture of nuclear weapons. Since the mid-1970's many have argued that all plutonium is equally dangerous regardless of quality.

(5) Strengthen both national and international safeguards systems to verify that nuclear materials are not diverted from civil power to nuclear weaponry.

Such measures could minimize the linkage while permitting further development of more efficient nuclear power technologies and reducing the basis for opposition. But, they could give no absolute assurance that plutonium would never be stolen or diverted in the United States or abroad to make nuclear explosives. Moreover, some feel they could further legitimize commercial production and use of plutonium, thereby setting a bad precedent for non-weapons states looking for an excuse to get closer to nuclear weapons without openly breaking pledges not to make them.

STATUS FOR SUPPORT OF NUCLEAR SAFEGUARDS TECHNOLOGY

Issue

Hearings by the Subcommittee on Energy Research and Production in August 1982 indicated that safeguards R&D at the DOE's national laboratories is of high quality, but is largely directed to short term problems with not enough long term R&D to assure that improved safeguards technologies for advanced nuclear fuel cycles will be available when needed.

Background

Central to U.S. efforts to prevent the further spread, or proliferation, of nuclear weapons is international inspection to verify that nuclear materials in States pledged not to make nuclear weapons are not diverted to this end. These inspections and other measures make up the international safeguards which are applied by the International Atomic Energy Agency. The United States, France, West Germany, the United Kingdom, other Euratom states, and Japan appear to expect plutonium will eventually be used as a commercial nuclear fuel, which raises questions about the adequacy of safeguards technology to assure timely warnings of diversion of civil plutonium in the future. While IAEA safeguards are thought adequate by most, although not all, to deter diversion of natural or low enriched uranium from contemporary fuel cycles, improvements will be necessary if and when plutonium comes into commercial use.

The U.S. funds much of the world's safeguards R&D through four Federal agencies and three national laboratories, but provides little money to the Agency to do R&D on its own. Most of the U.S. R&D is directed toward short term responses with little overall planning or direction. Coordinating bodies exist but have no authority to set goals, assign priorities or decide what R&D to do.

Analysis

Two basic alternatives are to: permit the safeguards R&D to continue as is; or to press the Administration to establish specific goals, develop long-range plans and organize to provide at least some central direction for the national safeguards R&D effort.

The first would require the least effort. Good work is being done in the national laboratories, and some of it can improve safeguards for facilities that may handle plutonium in bulk form. Also, improved technologies probably can be developed and demonstrated faster than the fuel cycles to which they will apply. Continuing delays and questions about the economics of breeders and plutonium and the decreased growth rate for nuclear power also reduce pressure for strong immediate action.

The second alternative recognizes prospects that plutonium will be used for nuclear fuel abroad before it is here. If the U.S. wishes to influence the safeguards systems and equipment built into new reprocessing and plutonium fuel fabrication plants abroad, it will need well developed and demonstrated technology in time to be incorporated in their design.

NUCLEAR WASTE MANAGEMENT

Issue

The 97th Congress devoted great energy to a comprehensive nuclear waste policy bill, dealing with Away-From-Reactor storage, State and Indian participation in the siting of waste repositories and other waste facilities, funding the waste program through utility payments, and setting of legislative deadlines for achieving various steps in the development of a waste repository. Passage of the waste bill in the last hours of the 97th Congress resolved much of the controversey involved in this issue. Exclusive of the provisions of waste policy legislation, however, the funding and character of the nuclear waste program, particulary the R&D portions of the program, will remain an issue for the 98th and future Congresses.

Background

Development of waste management technology has been a major budget item for the past 6 years. The activity has been directed toward developing waste forms, both for reprocessed high-level waste and for spent fuel, and investigating the characteristics of various geological media that are candidates for disposal. Some preliminary activity in the identification of potential repository sites has also taken place. However, the selection of potential sites has been complicated by the political sensitivity of the issue--a complication that the waste policy legislation was aimed at solving.

Analysis

Continued R&D in waste disposal would appear to require a setting in specific geological sites to be most efficient. A Test and Evaluation (T&E) facility, which would not require licensing by NRC, has been proposed as such a focus for R&D activities. However, the concept of an unlicensed facility for handling nuclear waste is a controversial one, and others have suggested that the program should concentrate on identifying and licensing a full-scale repository without going to the T&E route.

Another major policy question in waste management R&D is the relative importance of work on packaging of spent fuel and high-level waste. DOE is involved in a large-scale demonstration project at West Valley for solidifying and glassifying the waste produced by the pilot reprocessing plant there. No similar scale project is currently on the books for packaging of spent fuel. The decision on how much to support spent fuel R&D depends on a judgment of the likelihood and advisability of disposing of unreprocessed spent fuel. Since President Reagan lifted the ban on commercial reprocessing imposed by President Carter, one barrier has bee removed, but economic factors appear likely to delay, if not foreclose, the reprocessing option.

NUCLEAR POWER SOURCES IN SPACE

Issue

Spacecraft require electrical power to perform their functions. One method of generating this electricity utilizes nuclear energy, either using a radioisotope thermal generator (RTG) or a nuclear reactor. The Department of Energy has responsibility for research and development on space nuclear power systems, but these efforts have been conducted at a very low level because neither NASA nor DOD have stated their requirements in this area.

Background

Two types of nuclear power systems are utilized for powering spacecraft. The first is called a radioisotope thermal generator (RTG) and generates electricity through the decay of plutonium-238. The second is a small nuclear reactor using uranium-235. The United States has utilized RTGs for many years, especially for its planetary missions to the outer planets (where energy from the Sun would be too weak to provide electricity via solar cells). The Soviet Union does not use RTGs, but does utilize nuclear reactors for its radar ocean reconnaissance satellites. This was confirmed in January 1978 when one of these satellites (Kosmos 954) accidentally reentered over northern Canada, spreading radioactive debris over a large (but uninhabited) region of the country. (The United States has launched only one reactor, in 1965, and then terminated the program.)

The reentry of Kosmos 954 raised concerns in the international community over the safety of nuclear power sources in space. The matter is still being debated at the United Nations Committee on Peaceful Uses of Outer Space, but the Soviet Union resumed launches of that type of satellite in 1980.

In the United States, development of advanced space nuclear power sources is the responsibility of the Department of Energy (DOE). For the past several years, however, no effort has been undertaken to develop nuclear reactors for use in space, and only low-level efforts for RTGs. In the former case, this is partially because of the unresolved debate at the United Nations, and partially because DOE has not been given specific requirements by other agencies (such as DOD or NASA) for these types of systems. Recently, however, a dispute erupted between DOE and the Defense Advanced Research Projects Agency (DARPA) over which agency should develop space nuclear reactors.

In the case of RTGs, there is again the problem of a lack of requirements for more capable systems. As noted above, these systems are primarily used for planetary missions, and NASA has only one such mission currently scheduled.

Analysis

There is concern that at some point, DOD and/or NASA are going to require more capable space nuclear power systems and that the technology base will not exist because the programs are not moving forward at this time because of lack of specific requirements. In addition, a decision needs to be made as to whether DOE will continue to have responsibility for research and development on these systems.

VII. INFORMATION, COMPUTERS, AND TELECOMMUNICATIONS

CONVERGENCE OF COMPUTERS AND TELECOMMUNICATIONS

Issue

Data processing (computing) functions and data transmission (telecommunications) functions are converging as both become integral elements in all types of information systems. Not only do these technological advances enhance existing products and services, but they also make possible a wide array of new capabilities and applications. As a result, traditional definitions may no longer apply and existing laws and regulations may need reassessment. Today policymakers are grappling with how to (1) develop new ground rules which reflect the changing technology, (2) ensure fair access to the rapidly expanding information market, and (3) foster continued developments in information technology while providing protections to consumers.

Background

Rapid changes in information technology make it increasingly difficult to distinguish between computer and telecommunications services and products. At the core of the modern telecommunications network is a computer, i.e. an electronic switch. Similarly, the usefulness of data processing facilities is a function of their accessibility through telecommunications links. In addition, the growth markets for telecommunications and data processing are in these merged services, such as electronic message systems and home information systems.

In recent years the executive branch, the courts, and Congress have all addressed the issues arising from this convergence of technologies. The Federal Communications Commission announced in 1980 its Computer II decision which abandoned attempts to distinguish between telecommunications and computers. This decision divided services into two categories--basic and enhanced--maintaining regulation over the first and deregulating the second. The settlement of the Justice Department/ AT&T antitrust case in early 1982 likewise has caused substantial change for the information industry. The settlement requires AT&T to divest the 22 local operating companies, but allows the company to enter into unregulated markets. Finally, different legislative proposals emerged in the 97th Congress (S.898 and H.R. 5158) which sought to revise the Communications Act of 1934 to reflect the changing technology and market forces.

Analysis

The debate over the role of government in the information industry continues in the wake of the major actions taken by the FCC and the courts. The pace of technological development consistently outdistances the rate at which institutions can cope with these new challenges. There are some who advocate deregulation so that market forces can shape industry boundaries, availability of products and service offerings. They contend that competition will be the best method for fostering continued technological development, introducing new products and services, and reducing costs.

Others maintain that while Government should reduce regulation, it also should support technological developments through such things as tax incentives. Finally, certain groups contend that without government acting as a referee only large companies will survive, entry into new markets will be thwarted, and consumers will be faced with higher costs and fewer choices.

FEDERAL AGENCY RESPONSIBILITIES FOR INFORMATION AND TELECOMMUNICATIONS POLICY FORMULATION

Issue

Advancements in data processing and telecommunications technologies create new opportunities for efficient information transfer, make possible a proliferation of new products and services, and provide improved information support for decisionmakers. As the economy becomes more service oriented, there is a concommitant increase in the reliance on information and the value attached to it. This transformation in society raises substantial new public policy issues. Various interest groups are concerned that (1) the United States can no longer afford to address these issues in a piecemeal fashion and (2) this Nation must have coherent and coordinated information and telecommunications policies.

Background

The transition to an information-based society in recent years has focused attention on the importance of computer and telecommunications technologies in all aspects of society. In addition, the worldwide leadership of the United States in computer and telecommunications technologies has been increasingly challenged by Europe and Japan. These developments have prompted a renewed look at policymaking activities in the United States Government.

During the 97th Congress, legislation (H.R. 3137) was introduced to create an Institute for Information Policy and Research in the executive branch responsible for conducting policy research and analysis and developing policy options. Hearings on this legislation highlighted the economic stakes involved in optimizing the new information technologies and reviewed the various Government entities involved in some aspect of information and telecommunications policymaking.

Analysis

Information and telecommunications issues are addressed in virtually every agency and department of the Federal Government. Although there are several key players responsible for formulating and coordinating information policies, no single authority exists and existing coordination mechanisms have not always been successful. A number of interests see the need to more precisely delineate responsibilities for information policymaking, increase resources, elevate the issues to a higher level of authority, and improve coordination among agencies and between the public and private sectors. Some advocates propose creation of a centralized authority, such as the Institute for Information Policy and Research, as a means of improving the policymaking process.

On the other hand, there is opposition to centralizing information and telecommunications policy formulation. Opponents are concerned that an issue which permeates so many Government activities should be handled within the operational settings of mission agencies. Another difficulty they cite is defining the scope of information and telecommunications policies to be handled by any one agency that might be created.

FEDERAL MANAGEMENT OF INFORMATION TECHNOLOGY: IMPLEMENTATION OF THE PAPERWORK REDUCTION ACT

Issue

Given its increased dependency on information technology resources and the rapidly changing technological environment, the Federal Government has sought new approaches to managing these resources. The Paperwork Reduction Act of 1980 (P.L. 96-511), designed to provide a management framework, is being implemented. How effective has the implementation been and what are the implications for the Federal scientific and technological communities?

Background

Over the years the Federal Government's use of information technology often has been the center of innovation and controversy. Dependence on these technologies, coupled with budgetary limitations, places emphasis on effective management of these resources. Since many scientific and technology oriented activities are intimately involved with information and computer technologies, specific concerns have been expressed regarding effective use of the technology, acquisition and procurement of computers and telecommunication technologies, and the development and establishment of technical standards. The Paperwork Reduction Act of 1980, which is designed to promote the effective use of Federal information resources as well as to improve Federal use of computers and telecommunication technologies, provides a special focus.

The framework for the management of information technology resources involves the individual Federal agency and the central management agencies, including the Office of Management and Budget (OMB), the General Services Administration, the National Bureau of Standards of the Department of Commerce and the Office of Personnel Management. The many relevant Federal regulations and directions, coupled with the quick pace of technological change, provide a unique environment which challenges the Federal information resources manager.

Analysis

The low level of official guidance and the lack of uniformity in implementation of the Paperwork Reduction Act has triggered concerns regarding effective management of Federal information resources. Use of information resources, especially as it relates to Federal programs, remains a continuing concern. In a preliminary review, the General Accounting Office found that OMB had not complied with over 20 of the Act's requirements. Specific programs mandated by the Act, such as the Federal Information Locator System (FILS), have not made much progress. In addition, Federal agencies have not always been encouraged to plan strategies which would enhance the use of computer and information technologies.

Critics have expressed concern that Federal management of information technology as required by the Paperwork Reduction Act has not been effective. They cite lack of leadership and guidance as hampering implementation of the Act. Concerns have been raised that agencies, lacking effective guidance, have not been fully encouraged to plan effectively for the use and acquisition of automatic data processing and telecommunications systems. In response to this criticism others hold that the lack of restrictive guidance permits Federal agencies to experiment with more innovative approaches. They argue that this cautious approach is warranted in light of the limited experience with some of the underlying principles and concepts of the Act.

FEDERAL ROLE IN RESEARCH, DEVELOPMENT AND APPLICATION OF TELECOMMUNICATIONS, COMPUTERS, AND INFORMATION SYSTEMS

Issue

In the United States, computer, telecommunications, and information services are primarily owned and operated by private enterprises. The U.S. Government has played an historical role in fostering the development of these technologies and related services through support for research and development (R & D) of high risk endeavors. What the appropriate role of the Government is, both in supporting R & D efforts and in providing information services, has received increased attention in recent years.

Background

In the early years of computers and telecommunications, the Government sought to promote advancements in these technologies and their application in society through a number of supporting programs. In some instances, this took the form of research and development funding. In others, it involved the active participation of Government agencies in designing information systems which they then made available to the public.

More recently, as this field has continued to expand rapidly, there is a growing concern about what the proper role of the Federal Government should be as a developer of information systems, as a provider of information services, and as a supporter of research and development. Hearings during the 97th Congress addressed a variety of aspects of this problem. Included were issues concerning Government competition with the private sector, the need for scientific and technical information by both Government and the private sector, and alternative mechanisms for fostering increased private sector investment in these technologies.

Analysis

Proponents of a strong Federal Government role in this area point to concerns about increasing competition from abroad, the need to support mission agency responsibilities, and the importance of providing information services to the public which otherwise might be too expensive or unavailable. In some instances, however, advocates of active Government participation in some areas of information technology development are not supportive of a strong Federal role in others.

Opponents of the U.S. Government playing a significant role in supporting both technological developments and provision of information and telecommunications systems and services focus on the competition this causes with the private sector. Particularly, they focus on databases which compete with similar commercial offerings and transaction systems—such as electronic mail and electronic funds transfer--in which the Government is seen as potentially monopolizing a segment of the market and setting prices. Some industry spokesmen advocate Government support of private industry efforts in telecommunications and computers through such things as tax incentives and deregulation, rather than R & D funding and provision of information services.

ELECTRONIC PUBLISHING

Issue

Videotex, a generic term referring to the provision of information directly to the user by electronic means, has been much heralded as a means of mass communication. While the concept of videotex or "electronic publishing" is new, the technology is not; rather it is a new by-product of the convergence of telecommunications and computing technologies. As with other technologies in the early stages of development, Federal policy could have a direct impact on the success and growth of the industry. Specifically, how should electronic publishing be regulated, organized and structured; additionally, what companies should be allowed to offer services, at what price and under what restrictions.

Background

Videotex encompasses the technologies of teletext (one-way) and videotext (two-way) computer-based retrieval systems in which information can be widely disseminated via communications links, such as television signal and telephone line. The industry is emerging in a policy environment in which communications media (broadcasting, common carrier, and cable) have been regulated and computer manufacturers have largely remained unregulated. Since electronic publishing represents the merging of these two trends, it challenges traditional policy distinctions set forth by the Federal Communications Commission (FCC). Indeed, the FCC, through the First and Second Computer Inquiries, has been striving to establish a regulatory framework for this hybrid area of integrated computer communications.

There appears to be no single clear-cut path into the future for teletext and videotex; instead, there appear to be many alternative directions in which these systems can develop and function. It is difficult, at this time, to predict with any certainty the configurations supporting electronic print services for residential and commercial users. The United States, unlike governments in Western Europe and Canada, has maintained a neutral policy stance relative to the introduction of these technologies.

Analysis

A number of FCC regulations, such as the Equal Time Rule and the Fairness Doctrine currently affect broadcast content. Since teletext and videotex may be distributed in a number of ways via a number of communications media, and under different content rules, policymakers will need to decide how much of the FCC's broadcast related rules should be applied to the new services and what content can and cannot be self-regulated by the information providers.

Another area of concern for policymakers is the role American Telephone & Telegraph (AT&T) will assume in the videotex industry. The Justice Department settlement of January 1982 allowed AT&T to enter unregulated fields, including videotex, after divestiture of the Bell operating companies; however, in the

decision handed down by Judge Greene in August 1982, AT&T is barred from offering electronic publishing services for seven years. Additional policy issues that need to be addressed include whether or not standards should be adopted, what copyright protection can be provided by existing statutes, and how privacy of data can be ensured.

An overall policy goal for teletext and videotex could be to provide a product service mix which yields a maximum chance for market success unencumbered by needless regulation, but still providing protection to citizen-consumers. Three broad policy alternatives are discernable for achieving this goal:

1. Emphasis on deregulation where teletext and videotex are regarded as but one of many information sources and therefore should be available at costs determined in the marketplace;

2. Emphasis on regulated monopolies whereby teletext and videotex organizations are given enclusive franchises to deliver specific services and the rates they charge customers and their profits are regulated; and

3. Emphasis on semi-regulated monopolies whereby aspects of a particular service are under the aegis of a particular government agency, much like broadcasting is today, with competition permitted and no rate-of-return regulated.

TRANSBORDER DATA FLOWS

Issue

The rapid development of computer systems and telecommunications networks provides increased efficiency in transferring information on a global basis. At the same time, barriers have been erected by several countries to regulate the transmission of data across national boundaries and impede the free flow of information worldwide. These events have raised questions about how the United States can best promote U.S. interests abroad and establish effective policies for countering foreign restrictions on transborder data flows.

Background

Many countries are increasingly concerned about the growing amount of data--personal data about individuals, commercial information, and national economic data--being processed and stored in computer systems outside their countries. Several nations have responded by erecting barriers--both tariff and non-tariff--to the flow of information and have developed national strategies for information and telecommunications development. While many of these barriers represent economic concerns, others reflect such social and political concerns as personal privacy and national sovereignty.

The effect of barriers to international information flow is only beginning to be realized. Substantial damage may be caused both to the U.S. economy and to fundamental principles of the free flow of information. Hearings and legislation during the 97th Congress focused on the need for the United States to take positive steps to respond to the efforts by foreign nations and multinational organizations to restrict transborder data flows. How the United States can best establish effective policies which represent the interests of both U.S. enterprises and the Nation at large is currently under debate.

Analysis

A variety of approaches have been suggested for improving the ability of the United States to effectively respond to challenges to transborder data flows. One approach, which was proposed in legislation introduced in the 97th Congress, is to create an interagency group responsible for policy formulation and coordination of agencies' programs and positions. Another initiative was contained in authorizing legislation for the National Telecommunications and Information Administration of the Department of Commerce. That agency has been charged with conducting a comprehensive study of the long-range international telecommunications and information goals of the United States and reporting to Congress on the best strategies to pursue, including a review of the existing U.S. Government structure.

Other reactions to the transborder data flow problem have been to suggest retaliatory action. Legislative proposals to establish reciprocity with the Nation's major trading partners in telecommunications and information have lost support, but a provision cutting off U.S. funds to UNESCO, should that organization restrict the free flow of information, became law in the State Department's authorizing legislation for FY82-83.

ROBOTICS AND AUTOMATED MANUFACTURING TECHNOLOGY

Issue

Factory workers, and the labor unions to which they belong, want to be assured that the use of robots and automated manufacturing technology will not dehumanize their working conditions, reduce their earning power, render their working knowledge and skills obsolete, or make their jobs redundant. Management officials in manufacturing industries claim that the use of robots and automated manufacturing technology is essential for improving productivity, reducing labor costs, improving product quality, and conserving materials. The principal issue is how best to meet the needs of both parties and the Nation as a whole.

Background

Since the late 1960s, one focus of industrial research has been on increasing the "intelligence" of machines without necessarily increasing their mechanical power. The use of electronic digital computers in the industrial design and manufacturing processes and the employment of robots on the production line reflect the emerging emphasis.

Research on robots, automated manufacturing, and artificial intelligence appears to be increasing in the United States. It is being performed largely by universities, although nonprofit laboratories, in-house Government laboratories, and private firms are getting increasingly involved. The United States Government contributes funds to many of these efforts.

To a number of experts, it appears that Japan has been more responsive to robotic and automated manufacturing research and implementation than has the United States. Japanese managers work very closely with their national government and appear able and willing to tolerate the high initial costs of incorporating robots into their production processes and to accept a much longer payback period than their American counterparts.

Analysis

As the United States proceeds towards wider use of robots and automated manufacuring technology, large-scale dislocations of labor may occur in several geographic areas, new skills and knowledge requirements may arise, and working times and styles may be altered. In addition, foreign competition in robotics may intensify. These developments would place further strains upon the Nation's economy. On the other hand, new robot-based industries could arise, as well as new and efficient manufacturing processes, technologies, methods, and occupations. Improved production approaches could lower prices and expand markets for U.S. manufactured goods and improve the utilization of scarce resources, including energy, materials, and capital.

A forceful demand by labor and by managers for training and retraining in automation and computers probably would arise. Industrial organizations may partially assume responsibility for this training and retaining. Conceivably,

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the Federal Government could assist in this regard. However, there is a question as to how effective such training would be for unskilled and semi-skilled labor and whether there would be other types of jobs available to them even if they did get retrained.

There are a number of initiatives that private industry could take to facilitate the adjustment of workers to advanced manufacturing automation. These include emphasizing natural attrition rather than layoffs, furloughing employees on a rotating basis, instituting part-time work and job sharing programs, providing for early retirements, and developing new jobs for displaced workers.

The potential and complex problems of advanced automation may require solutions that transcend normal bargaining agreements between unions and management. Responsibilities may have to be shared by all key members of society--business, labor, special interest groups, and governments, including Congress.

JAPANESE SUPERCOMPUTER DEVELOPMENT ACTIVITY

Issue

The Japanese have undertaken a major effort to surpass American companies in providing high-speed "supercomputers" which are used primarily for defense and research purposes. At the same time, in a government supported enterprise, computer manufacturers in Japan have initiated work on a "fifth generation" computer which is capable of artificial intelligence. There is a growing concern that (1) through these combined efforts, the Japanese could capture a substantial share of the world computer market and (2) unless U.S. manufacturers can match these developments, this Nation may become dependent on Japanese producers of high-speed computers.

Background

The United States traditionally has been the leader in development of high-speed computers and in advancements in computer technology. There are approximately 50 supercomputers in use today, primarily in Government laboratories for solving complex scientific problems and in national defense. They are capable of performing large numbers of calculations at a speed three to 100 times faster than the largest general purpose business computer.

Recently, Japanese manufacturers have introduced their first supercomputers approximately equal in computing power to U.S. designs. In addition, the Japanese Government has announced an aggressive program to build machines which can surpass the existing American supercomputers. These actions have raised concerns on the part of the U.S. scientific community, which relies heavily on these devices for conducting basic research. Some observers see a parallel between what is happening in supercomputers and what previously occurred with Japanese semiconductors--where a combined government-industry effort in Japan enabled them to capture a major portion of the world market.

Analysis

There has been a mixed response in the United States to this latest challenge by the Japanese computer industry. A recent report by the National Academy of Sciences suggests that the United States undertake a national program involving Government, industry, and academia to foster further development of supercomputers. The report reflects a concern that U.S. scientists will be forced to turn to Japanese supercomputers to conduct basic research and to support national defense unless the United States Government joins together with industry to advance the technology.

Opponents of such an approach believe that private industry will be able to keep stride with Japanese advances without the active involvement of the Federal Government. While supporting increased attention by the Government to this issue and its role in high-risk basic research, many U.S. manufacturers would rather keep responsibility for designing and building supercomputers in the private sector.

COMPUTER UTILIZATION IN FEDERAL LABORATORIES

Issue

The increased dependence of Federal laboratories on computer technology has contributed to concern about their effective utilization of these tools. In addition, critics have voiced concern that the requirement to meet Federal computer procurement regulations has prevented some Federal laboratories from adequately meeting their computer needs.

Background

Federal laboratories, a valuable national resource, deal with problems which are not only complex but which are often on the leading edge of science and technology. Computers, as essential tools in the laboratory environment, continue to be in transition. The quick pace of computer technology developments and the emergence of new data handling techniques has contributed to concern about appropriate computer resources management. While technological innovations continue to expand computer capabilities, organizational structures and management requirements have not always been sufficiently flexible to meet the challenge.

Analysis

Federal computer acquisition and procurement procedures have not always kept pace with the changing and demanding laboratory environment. Critics claim that, in some instances, Federal procurement requirements, along with internal laboratory management policies, have hampered Federal laboratories in obtaining appropriate computer capabilities. The lack of comprehensive research on Federal laboratories computer management problems makes it difficult to substantiate any of these claims.

Other critics have been concerned about the seemingly poor utilization of certain computer systems. It has been suggested that consideration be given to exploring new management approaches, both at the laboratory and agency level, to cope with the changing technology and the demanding requirements of laboratory programs and projects.

Some options that may be considered are to (1) assess the use of computer technologies in the laboratory environment; (2) explore existing and potential Federal laboratory computer requirements; (3) evaluate advantages and limitations of Federal computer procurement regulations in the laboratory environment.

COMPUTER TECHNOLOGY IN SUPPORT OF NATIONAL SECURITY AND COUNTERTERRORISM

Issue

Safeguarding the Nation from foreign intelligence penetration and terrorism remains a vital national goal. Advances in computer technology have special promise in protecting national security and as a countermeasure to terrorist activities. However, there appear to be problems in the national security community concerning possible redundancy among system and program development and a lack of effective coordination among agencies in these areas.

Background

Advances in computer technology continue to be promoted by those agencies responsible for national security. Specifically, advances in artificial intelligence, computer linkage systems, machine translation, and computer security measures are being used to promote national security and, in some instances, protect against terrorism. The establishment of the Department of Defense Computer Security Evaluation Center at the National Security Agency is largely directed at encouraging the private sector development of appropriate computer security measures. Also, the hardware and software standardization efforts affecting "secure" information technologies remain a central concern of the national security community.

Analysis

A major criticism of Federal programs in applying computer technology to national security areas has been the lack of a comprehensive framework and overall direction. Historic barriers to information exchange among responsible agencies have served to limit application of computer technology. While there has been some attempt to create organizations in the national security community to provide oversight in information activities, these groups have not always been successful.

Critics express concern over the danger of systems development redundancy that may occur in the national security community. Also, certain agency programs, in the view of some critics, may not always lead to effective computer technology applications. Another example of a possible problem is that the NSA computer security evaluations and the National Bureau of Standards computer certification program may represent a redundancy and may require clearer delineation.

Gaining knowledge on computer technology applications is difficult, partially due to the barriers, that exist in some parts of the national defense and intelligence communities. This factor, coupled with the lack of information on specific technologies, may limit applications of new computer technologies or fail to identify those that may be inadequate.

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INFORMATION TECHNOLOGY FOR EDUCATIONAL, AGRICULTURAL, AND SOCIAL SERVICES

Issue

The application of computers and telecommunications technologies to educational, agricultural, and social services has the potential of broadening the range and improving the quality of these services while at the same time decreasing their costs. However, these technologies have hardly been applied to social services, and have only recently been utilized in school systems and agricultural operations. At present, the principal issue is what role the Federal Government should play in stimulating the growth of information technology in these areas and in encouraging cooperation between the public and private sectors to achieve this goal.

Background

In general, social service personnel in community health centers and public welfare agencies have not incorporated information technology in direct professional services to clients. Due to the geographic fragmentation of the Nation's social service system practical and professional problems, and some reluctance of professional social workers to perform their work with technology that is considered "dehumanizing," computer applications have been restricted to administrative and budgeting tasks.

In education, there are a number of factors that have hindered the application of information technology in the classroom. These include little "grassroots" support for such technology; resistance by school administrators who are constrained by limited funds; reluctance by teachers to combine electronic technology with traditional teaching methods; and lack of quality software. Gradually, these problems are being addressed and various forms of information technology are being introduced into the Nation's public and private primary and secondary schools.

As with social service practitioners and educators, the introduction of information technology into agriculture has been greeted by a wary attitude on behalf of farm users. Nevertheless, the momentum for providing computer-based services to the agricultural sector is increasing steadily as farmers are realizing the financial advantages to be gained by integrating these systems into their operations. Both the public and private sectors are becoming actively involved in designing on-line agricultural databases, farm management software, and electronic trading systems for farmers in all parts of the Nation.

Analysis

The application of computers to uniquely professional social service tasks raises important questions of accountability and confidentiality. What will prevent the information being used for purposes not related to client services? Who will have access to the information and under what conditions? The use of information technology in the area of professional decisionmaking, as distinct from administration, also involves questions of professional standards and ethics which take a long time to identify and analyze.

The introduction of information technology to the educational setting on a wide scale may evolve new roles and responsibilities for the classroom teacher. He or she may have to reconceptualize traditional approaches to learning and increase his or her creativity and initiative. Incentives may have to be devised in order to mobilize the talent required to produce effective software and courseware as well as to direct and monitor the operation of diverse types of computer and telecommunications-based equipment in the schools. Finally, the risk that technology-based education will be improperly used to propagandize and condition people's tastes and beliefs will have to be minimized.

The expanding use of information technology in agriculture raises an important question about the appropriate role of the Federal Government in these activities. Should the U.S. Department of Agriculture (USDA) provide funding support for research and pilot projects similar to the assistance offered to the Green Thumb videotext program? Further, what steps should USDA take to ensure that the vast amount of information at its disposal is disseminated in a timely manner to all members of the agricultural community, particularly limited-resource farmers? Additional issues that need to be addressed include the role of USDA Extension Service personnel in introducing these information systems to farmers, and access to Government data by private sector information providers.

INFORMATION TECHNOLOGY IN EMERGENCY MANAGEMENT

Issue

In the first session of the 97th Congress, the Subcommittee on Investigations and Oversight of the House Committee on Science and Technology undertook a scrutiny of the present and potential roles of information technology, especially computers and telecommunications, in emergency management situations. A subsequent technical forum sponsored by the subcommittee further explored the roles and responsibilities of public and private sector organizations in this critical area.

Background

The range of emergencies or "disasters" which must be coped with, whether of natural or man-caused origin, is large: earthquakes, fires, assassinations, terrorist attacks, nuclear meltdowns, toxic spills, and so forth. In many instances, those governmental agencies--Federal, State, and local--and private groups with pertinent responsibilities have failed, in the words of one Member "to bring to bear either the technology or the management capability needed to respond quickly and effectively to the demands of stress situations."

The creation or upgrading of key "watch centers" capable of coping with the broad spectrum of potential disasters is an option under consideration. Such focal mechanisms can fulfill an essential role in gathering, structuring, retrieving, and disseminating selected information relevant to impending or occurring crises, contingency planning, man-machine actions during conditions of stress, all of which are imperative if decisionmakers are to develop responsive action alternatives and initiate corrective action.

Analysis

The boundaries of congressional cognizance of this area will probably include the four phases of emergency management: mitigation, preparedness, response, and long-term recovery. The commonality of these closely interrelated activity parameters and the ways in which sophisticated information technology can enchance the ability of governmental and private sector organizations to confront disasters deserve further attention.

Several issues have been identified which are of such high priority:

- o Is there a current, valid, long-range plan addressing the role of communications networks in emergency situations?
- o Has the optimum use of advanced information technologies in various disaster scenarios been studied, and plans for their operational utilization developed?

- o Have priorities been determined for the creation, maintenance, and use of those essential information files which may be available to decisionmakers during emergencies?

- o Are the advantages and disadvantages of various technologies employed in anticipating or responding to natural or man-caused disasters understood by those managers or operators responsible for their use?

- o Will secure communcations be available in contingency situations?

- o Is there a need to review present emergency management concepts and plans, particularly, those concerning the roles of "watch centers," networks, and key human resources?

Within the context of the recent consolidation of the Federal Emergency Management Agency (FEMA) and congressional oversight activities focusing on civil defense and related activities, a need has been for perceived action which could include:

1. Taking advantage of the technology that is already on the shelf to upgrade our emergency management systems around the country.

2. Developing in our civilian managers the sensitivity to train for emergency situations and give priority to utilizing simulation in their regular work.

3. Drawing upon the expertise that has been developed in the national security arena in order to better deal with natural disasters.

COMMUNICATION SATELLITES

Issue

A number of issues are likely to arise in the 98th Congress concerning communication satellites, including the stability of NASA's R&D program for advancing communication satellite technology, future prospects for direct broadcast satellites (DBS), and U.S. participation in the 1983 ITU conference at which orbital slots and frequencies will be allocated for DBS.

Background

The United States is in danger of losing its world leadership in communication satellite technology to other countries (notably France and Japan) both in terms of building specific satellite components (e.g., traveling wave tubes), and in competing for contracts to construct communication satellite systems for world-wide customers.

One part of the problem is that NASA's program for developing new communication satellite technology was terminated in 1973 on the basis that the the private sector should perform this R&D. In 1979, NASA reentered the field when it became obvious that the private sector would not accept that role. In 1981, President Reagan reversed policy again and NASA's effort was severely curtailed, but in 1982, Congress reinstated funding for this program and it now appears that the Reagan Administration will support NASA's continuing role in advanced communication satellite R&D.

One type of advanced communication satellite is for broadcasting television directly to rooftop antennas. This concept, called direct broadcast satellites (DBS), is expected to be introducted in the United States in the 1985-86 time period and eight U.S. companies have been granted satellite construction permits by the Federal Communications Commission (FCC).

Analysis

The vascillations in Administration policy during the past decade regarding the role of the Government versus the private sector in advanced communication satellite technology leads to questions about the stability of the NASA program. Without technological advances, other countries may win this lucrative market away from U.S. companies. Congress may wish to assure the future stability of NASA's efforts in this area.

Regarding DBS, the International Telecommunication Union (ITU) is responsible for allocating frequencies and orbital slots for satellites--a highly political issue pitting developed and developing countries against each other. The ITU conference at which a DBS allocation plan will be developed for North and South America will not be held until June 1983, raising questions as to whether the FCC acted prematurely in granting DBS construction permits prior to this meeting. One line of reasoning is that the United States will give the appearance of attempting to take too large a share of the orbital slots; the counterargument is that we are more likely to leave the conference with an acceptable allocation scheme if we enter the conference with definite DBS plans. How well the U.S. delegation is prepared to handle these types of arguments may be key to overall U.S. success at the conference, and Congress may wish to provide oversight of these preparatory activities.

VIII. INTERNATIONAL SCIENCE AND TECHNOLOGY

IMPLEMENTATION OF PRESIDENTIAL AND DEPARTMENT OF STATE RESPONSIBILITIES FOR SCIENCE AND TECHNOLOGY IN FOREIGN POLICY AS MANDATED IN P.L. 95-426

Issue

Title V of P.L. 95-426, the fiscal year 1979 Foreign Relations Authorization Act, gives the President and the Department of State special responsibilities for systematically improving the formulation of foreign policies dealing with science and technology. Annual reports are required on steps taken to implement these actions. Three reports have been published so far.

Background

Title V of P.L. 95-426, the Foreign Relations Authorization Act, is entitled "Science, Technology, and American Diplomacy." Not only does it underscore the importance Congress gives to S and T in foreign policymaking, but it gives the President (in consultation with the Office of Science and Technology Policy) and the Department of State specific training, information gathering and assessment, and reporting responsibilities for foreign policymaking that deals with S and T.

The annual presidential report is required to make recommendations on: (1) needs for training and personnel standards for all Federal staff involved with foreign policy and S and T and (2) status of bilateral and multilateral S and T agreements, including assessment of the S and T benefits of such agreements, the adequacy of the funding for such agreements, and plans for the evaluation of such agreements.

Analysis

Workshops and critiques on the oversight of Title V indicate that policymakers in the Department of State hold different views about how pervasive science and technology are in determining international relations. The Title V philosophy may not pervade the activities of the Bureau of Oceans and International and Environmental Affairs (OES) of the Department of State as much now as it did in 1979 and 1980. Nevertheless, the obligations imposed by the law are clearly perceived by the Department. The termination of the Policy Assessment Staff office in OES does not necessarily signal disavowal of the importance or need for long-range planning. However, the long-range planning function is apparently not being given the focus it had during the first few years during which the statute was implemented. This may, in large measure, result more from difficulties encountered in doing long-range planning in the crisis-oriented environment of diplomacy, rather than from a deliberate policy decision to de-emphasize planning. While calls persist to improve training programs and interagency personnel exchanges, the Department's initiation of a course on "Science, Technology, and Diplomacy" in the Foreign Service Institute accords fully with the purpose of the Title V legislation. The State Department appears to be improving the processes used in preparing the Title V report, but, according to critiques, special attention seems needed to improve discussions of the foreign policy implications of international science and technology activities and analyses of funding and personnel requirements.

THE STATUS OF U.S.-SOVIET S&T RELATIONSHIPS

Issue

If U.S.-Soviet scientific cooperation were to be renewed, how could the design of new cooperative relationships benefit from the experiences gained from the relationships begun in 1972?

Background

During the period 1972 to 1974, the United States and the Soviet Union signed 11 bilateral agreements for cooperation in scientific and technological areas, specifically in: science and technology, energy, atomic energy, space, public health and artificial heart research, housing, transportation, environmental protection, the world oceans, and agriculture. Each agreement lasted for five years. The second renewal period began in 1982. However, according to a State Department report, in 1979 in response to the Soviet invasion of Afghanistan, the scope and level of activities under the 11 bilateral agreements for scientific and technological cooperation with the Soviet Union were reduced significantly. High-level Joint Committee meetings, which previously reviewed past activities, provided guidance, and approved new projects for areas of cooperation, did not take place in 1981. There were no plans to have high-level contacts and meetings in 1982. During 1981, low-level exchanges occurred under the auspices of all agreements except agriculture and energy. Most bilateral activities occurred in the areas of health and environmental protection. Overall activity under the exchange agreements remains only about 25 percent of the pre-Afghanistan level. Following the Soviet intrusion in domestic activities in Poland in December 1981, the Administration made a decision not to renew the S an T, energy, and space agreements when they expire in 1982, and to review all the other agreements. According to the State Department, "planning for future activities has not extended beyond the agreements' expiration dates."

Analysis

If the situation should change with evidence of a rapproachement between the United States and the Soviet Union, the U. S. Government may resume more cordial diplomatic and trade relations with the Soviet Union and may seek to resume the cooperative agreements. The Reagan Administration reviewed the quality of science and diplomatic utility of the agreements shortly after taking office. If U.S.-Soviet cooperation were to be renewed, how could the design of a new cooperative relationship benefit from the experiences gained from the cooperative relationships begun in 1972? (NSF is now studying this issue.) How could new programs be designed to overcome the apparent weaknesses of previous programs, i.e., lack of reciprocity in science and weaknesses in management on the U.S. side. In which areas does U.S. science profit from contact with Soviet science, and which areas have suffered from the cutbacks? If the Soviet Union is not fully capable of absorbing technology, as some scholars allege, how much should national security considerations affect U.S. Soviet scientific exchange policy?

THE STATUS OF U.S.-PRC S AND T RELATIONSHIPS

Issue

The United States and the People's Republic of China have negotiated cooperative scientific and technological agreements including two-way exchanges of scholars, formal exchanges of high-level scientific advisory and administrative personnel, and agreements on specific types of scientific and technological cooperation. Oversight may be required of funding for and policy governing these programs, specifically in relation to the commitments embodied in, and the coherence and the consistency of, the exchange program, and the current moves to place surveillance on Chinese exchange students and visitors to stem alleged flows of inappropriate scientific and technical information.

Background

The United States-People's Republic of China Agreement on Cooperation in Science and Technology was signed in January 1979, soon after the announcement of normalization of relations between the two countries. The executive body for the agreement is a Joint Commission co-chaired for the PRC by Vice Premier Fang Yi and on the U.S. side by Dr. George A. Keyworth, Director of the Office of Science and Technology Policy (OSTP). OSTP serves as the executive agent for the agreement on the U.S. side. The State Department's Bureau of Oceans and International Environment and Scientific Affairs provides the U.S. executive secretariat. The executive agent on the Chinese side is the State Scientific and Technological Commission. The United States and China have signed 17 technical protocols for cooperation in such areas as exchange of scholars and students, cooperation in medicine and public health, agriculture, marine and fisheries science, earthquake studies, building construction and urban planning science and technology, cooperation in nuclear safety, and surface water hydrology. Each U.S. agency that participates in the activities of the agreement funds the activity from its own budget.

Analysis

U.S. experience in conducting scientific exchange activities indicates that such agreements must be based on well formulated plans for nurturing S and T exchanges that are beneficial reciprocally to the scientific and political aims of both participants. Funding has to be adequate and political goals appropriately appreciated. It would seem wise to assess the outcome of the U.S.-Chinese bilateral activities in these terms. Are national security measures which lead to the surveillance of Chinese students detrimental to the future of cooperation between the two countries? Does the United States have a long-term policy perspective on the PRC to help guide its exchange activities? Should the United States clarify the status of the PRC and the application of U.S. laws to it in order to systematize scientific relations with the PRC, dealing with the way PRC scientists are treated in Government laboratories, the issuance of export licenses, and the availability of concessionary aid and credit? Does the United States give science and technology in the bilateral relationship the same importance as the Chinese?

U.S./LATIN AMERICAN RELATIONSHIPS IN SCIENCE AND TECHNOLOGY

Issue

Scientific and technological relationships between the United States and the Latin American nations takes on new meaning as this Nation attempts to devise policies to cope with conflicts between Latin American demands for a "New International Economic Order," and U.S. domestic needs to open up new markets for U.S. products, gain favorable terms of trade to ensure access to Mexican oil, and meet national security and foreign policy commitments toward Latin America. Public and private policies, both bilaterial and multilateral, may not be adequate to cope with these conflicting requirements.

Background

The assumption of a special relationship between the United States and Latin America takes on new meaning in the S and T area. Many critics say that this Nation has not developed clear-cut policies to help promote S and T development of these nations. Existing bilateral and multilateral relationships and U.S. private investment and technology transfer policies are cited for inconsistency and inability to meet the region's needs to overcome dualistic development patterns and to build S and T infrastructure. Two-class societies persist, with upper classes profitting inequitably from foreign aid and assistance measures. Partly in an effort to overcome these problems, some Latin American nations are beginning to establish common markets with trade barriers to developed nations, including restrictions on the inflow and outflow of technical information (to prevent multinational corporation takeover of domestic resources and markets and to help develop indigenous knowledge bases and production skills needed to enlarge the import substitution sector to meet product needs of lower and middle classes). Some countries are calling for a special tax on foreign investors whose nations have unbalanced trade with Latin America to develop a special fund to finance S and T infrastructure and venture capital needed to promote indigenous industrialization processes. These nations are also instituting policies to stem the brain drain and develop knowledge bases applicable in Latin America. Evidence of these policies is seen especially in Mexico, the Andean Pact nations, and Brazil.

Analysis

It is alleged that these Latin American-instituted policies will cost the United States in terms of jobs, balance of payments, and access to cheap labor intensive natural resources. Is there sufficient understanding in this Nation of the costs and benefits to the United States of Latin American development initiatives? What are proper U.S. responses given the needs to promote Latin American development and U.S. economic growth? What efforts does the United States have to make to ensure access to Latin American natural resources? What compromises and consistencies are required in public and private scientific and economic policies to achieve mutual goals?

ISSUES RELATING TO THE COMPETITIVENESS OF JAPANESE TECHNOLOGY AND PRODUCTION METHODS

Issue

Japanese technological and industrial products and processes have proven to be significant competitive threats to American markets. At issue is how the United States can learn from the Japanese to better improve its international competitive position.

Background

Japanese firms apparently have copied, purchased, or adapted American technological knowledge and innovations as a basis for developing world-wide competitive products and processes. In many cases, the strength of the Japanese position can be attributed to its management and production methods, including labor-management cooperation; retraining of workers; use of robotics; life-time employment; tendency to save income; and a homogeneous population. The Japanese have been so successful that the United States has continued to show a negative balance of trade with Japan in R&D-intensive manufactured products.

Analysis

The Japanese have been able to make substantial gains in innovation and technological development. These have often been derived from the application of techniques and theories developed in the United States, but which American companies have tended to ignore. The Japanese have taken the findings of several American scholars, particularly that of W. Edwards Demings, and have adapted them to the unique Japanese environment. The "not-invented-here" syndrome does not exist in Japan. In addition to using U.S. business techniques, the Japanese are particularly adept at taking results of research performed elsewhere, making improvements, and manufacturing a high quality product.

Only recently have American company executives begun to recognize that management practices are contributing to industry's problems. While it would often be impossible to transfer the Japanese methods to U.S. firms directly, there is an increasing interest in adapting the Japanese techniques to the United States system, much the same as the Japanese adapted U.S. methods to their particular environment. Given the Federal Government's legitimate concern for economic growth and national security, the Congress may consider assessing those technological adaptations and management factors which make Japanese industry such a competitive threat to the United States in order to evaluate how American firms might profit from these methods.

TECHNOLOGICAL COOPERATION/COMPETITION AMONG ALLIES:
THE FUTURE ROLE OF THE UNITED STATES IN MULTILATERAL AGREEMENTS IN S AND T

Issue

The increasing cost of R and D and technological innovation in some areas, coupled with the effects of an economic recession, have made R and D more expensive and forced decisionmakers in the United States and allied countries to promote international cooperation in these areas. However, at the same time, the effects of heightened international trade competition among allies have raised questions as to whether the United States should discourage the transfer of potentially profit-making proprietary information. Several studies and conferences are underway on these issues. The Congress may be called upon to take a stand on them.

Background

Trade statistics show that the United States is beginning to lose out to its allied economic competitors in many areas of high-technology trade, due to many factors, including the possibly decreasing quality of U.S. scientific and technical education; aggressive and government-targeted innovation and development policies in other countries; and legal and illegal transfers of technical information. The National Academy of Sciences has a study panel, chaired by Howard Johnson of MIT, on this subject, due to report soon. At the same time, allied efforts are underway to determine areas of fruitful international cooperation in R and D. The President's science advisor, from time to time, has noted that the United States can no longer afford to be preeminent in all areas of science and that Western cooperation is necessary. The Organization for Economic Cooperation and Development is convening a conference on this subject in the fall of 1983, at the request of the Japanese Government. Additionally, it is expected that the President will submit more restrictive provisions when the Export Control Administration Act comes up for renewal in September 1983.

Analysis

In which areas of large-scale R and D should the United States seek to cooperate with allied nations? The National Science Board just began a study to evaluate the history and accomplishments of large-scale cooperative R and D projects in which the United States has cooperated. What are the implications of this study for U.S. policy choices? The Administration appears to have backed down on existing cooperative R and D relationships in coal gasification and liquefaction technology and other areas, leading some allied partners to question the sincerity and credibility of the United States in keeping its commitments. What policy changes are needed to ensure appropriate cooperation? What steps need to be taken to ensure that national investment toward the development of potentially commercial technology is not jeopardized, or the results do not accrue to inappropriate parties? If technological competition among allies is of major importance, what are the most appropriate steps to take to ensure that the U.S. technological posture does not suffer: (1) Improve the management, innovative, and development capability of American industry? (2) Halt the alleged legal and illegal transfer of U.S. technical information abroad? If it is determined that steps should be taken to halt the transfer of U.S. technical information, how can this be accomplished successfully without harming the normal interchange of scientific and technical information among allies?

THE EXPORT ADMINISTRATION ACT: IMPLICATIONS FOR SCIENCE AND TECHNOLOGY IN INTERNATIONAL MARKETS AND INFORMATION EXCHANGE

Issue

During the 1950s and again in 1981-1982, the restrictive provisions of export control laws were stringently applied to prevent the imparting of certain sensitive scientific and technological information, either directly or indirectly, to foreign nationals of particular countries. In general, these limitations have been used to protect the national security of the United States. Such restrictive actions have been criticized, among other reasons, as being based on too narrow a view of national security and too broad and imprecise an understanding of sensitive or critical data. An opportunity for assessing these arguments, both of which have important implications for science and technology in international markets and information exchange, will occur during 1983 when Congress considers renewal of the automatically expiring Export Administration Act.

Background

Until 1949 with the adoption of the Export Control Act (63 Stat. 7), the Federal Government traditionally restricted exports only in times of war or special emergencies. During the 1950s, the new export control statute was stringently applied to a variety of scientific and technological information. Controversy over this implementation of the law did not subside until a more liberal policy on exports to Communist bloc countries emerged during the 1960s and the Export Administration Act of 1969 (83 Stat. 841), reflecting this new position, was enacted.

During 1981-1982, the Reagan Administration again pursued stringent restriction of certain scientific and technological information according to the provisions of the Export Administration Act of 1979, as amended (50 U.S.C. App. 2401-2413). The statute allows limitations to be placed upon "the export of goods and technology which would make a significant contribution to the military potential of any other country or combination of countries which would prove detrimental to the national security of the United States." It also mandated the creation of a Militarily Critical Technologies List which, as the name suggests, contains a variety of militarily sensitive goods and technologies which are subject to export restrictions.

Critics of the Administration's stringent application of export controls to scientific and technological information have argued that national security cannot be attained through a policy of technology concealment but, instead, results from scientific and industrial achievement, which are dependent, to a considerable degree, upon open communication and information exchange. Such a position was recognized in the declaration of policy of the Export Administration Act indicating that the United States was "to use its economic resources and

trade potential to further the sound growth and stability of its economy as well as to further its national security and foreign policy objectices."

Similarly, a number of critics--the most recent among them being a study panel of the National Academy of Sciences--have urged that the Militarily Critical Technologies List be streamlined drastically to concentrate on technologies that are truly critical to national security. This change would narrow the range of scientific information subject to export controls.

Analysis

In the course of renewing the expiring Export Administratrion Act, Congress might explore several matters bearing upon a clarification of export control policy as it applies to science and technology in international markets and information exchange. An in-depth examination might be made, perhaps through selected case studies, of the impacts of secrecy--prompted by national security export restrictions--on science and technology and the related impacts of science and technology on national security. The purpose of such a study would be to provide an understanding of the effects of export secrecy on scientific and technological enterprise and the contributions that traditionally performed, i.e. open, science and technology make to national security.

In addition, an appreciation of all of the dimensions of the national security concept--military, economic, psychological, etc.--might be developed in order that its proper significance within the context of export control policy would be understood.

Finally, in continuing the mandate for a Militarily Critical Technologies List, some guidance or criteria might be set for its preparation, such as periodic updating, with outdated technologies being removed, and, as noted above, a broader view of national security considerations.

IX. LIFE SCIENCES AND TECHNOLOGY RESEARCH

ADMINISTRATION OF LIFE SCIENCES RESEARCH: COST EFFECTIVENESS OF RESEARCH

Issue

Basic research in the life sciences is of foremost importance in protecting the health of the American public and in advancing the quality of life of our citizens. This is particularly true as the average age of the population increases. In numerous fields of medical research, impressive scientific advances could be made if sufficient resources and trained manpower were available. As the costs of conducting research increase, however, and as Federal spending is scrutinized to avoid deficits, planners must make difficult choices about priorities in spending the life sciences research dollar. Careful study is needed to make research spending cost-effective and of maximum benefit to the health of the American people.

Background

The National Institutes of Health (NIH) is the focal point for federally funded intramural and extramural life sciences research, providing about 67 percent of all Federal funds for biomedical research and development. In the nearly 100 years of its existence, the agency has grown exponentially both in the size of its budget and in the scope of its research efforts. During the decades of the fifties, sixties, and seventies, new institutes were created and broad research initiatives such as the "war on cancer" were undertaken to address the major health problems of our population. A sophisticated research enterprise was fostered by NIH funding to universities and scientific institutes around the country. At the same time, young scientists had an opportunity to explore careers in research through support from NIH research training programs. The high point in real purchasing power of the NIH budget was reached in FY 1979. The relatively smaller budget increases in the years since then have not kept pace with inflation, with the result that the number of research grants and research trainees that can be supported each year has declined.

Analysis

Making effective use of available funds will require consideration of how to maintain a growing base of scientific knowledge and simultaneously pursue applications of research discoveries that will benefit the public health. Specific issues of concern may be: (1) the possibility of industry, foundations, or other private sources supporting more of the development of research, with Government funding directed primarily toward support of basic research (about 50% of NIH's budget now goes to basic research); (2) increased emphasis on disease prevention and health promotion, in addition to research on treatments and cures, toward the goal of a long-range saving of both money and suffering; (3) the need for a continual supply of young scientists, especially young physicians, to enter research careers; (4) the ever-increasing proportion of the research dollar chat is being consumed by indirect costs; and (5) possible modifications of the peer review system for awarding research grants, through such procedures as block grants, performance ranking systems, or productivity formulas.

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BIOMEDICAL TECHNOLOGIES: R & D ISSUES

Issue

The variety of medical technologies being used in the health care system has increased tremendously in recent years. What responsibility does the Federal Government have to conduct or support research on medical technology and its evaluation? How can research information be translated into guidelines useful for decision making?

Background

Medical technology can be defined as techniques, drugs, equipment, procedures and systems combining these elements, used in the delivery of medical care. With increasing numbers of such technologies being introduced into health care practice, cost-control pressures require consideration of, and information on, the costs, risks, benefits, and appropriate uses of individual interventions. The Federal Government has several roles to play in researching particular technologies, in evaluating the usefulness and implications of many medical technologies, and in studying the process by which new technology is developed and introduced into the health care system. Federal and other public agencies need information about medical technologies to support their decisions in resource allocation and policy formation. Consumer protection is served by Government involvement in evaluating the safety and effectiveness of medical procedures. Finally, the Government can support research efforts that may have only very long-term payoffs, or that may be collectively valuable to a number of sectors of society. In either of these cases, non-governmental research organizations would be unlikely to want to pay for the investigations.

Analysis

Health care planners today are faced with a proliferation of extremely expensive technologies and procedures, such as the various developments in diagnostic imaging, artificial organs, and life support systems, many of which benefit a small number of people. There is a need for better methods of evaluation for new and emerging medical technologies, since extensive controlled trials are neither affordable nor feasible for every technology. Two specific areas that warrant consideration are:

(1) Technologies for the handicapped. Micro-computer, microprocessor, and telecommunications technologies to assist the handicapped in their daily activities have multiplied over the last three years or so. Although many prototypes and experimental devices have been developed, there is currently no clearinghouse mechanism to identify, review, and evaluate available technologies. Questions may also arise regarding the regulation of these devices and technologies so as to protect the health and safety of the user.

(2) Contraceptive technologies. In this value-laden area, researchers and policy makers must explore both the state of the art of the technologies, and the state of available methods of transmitting information about the technologies to the medical and lay public. Because of social and cultural factors in the U.S. and abroad, new discoveries in natural family planning methods may have impacts that surpass developments in other forms of fertility control such as barrier methods, long-acting injectable contraceptives, or chemical sperm inhibitors.

DEVELOPMENTS IN BIOTECHNOLOGY AND THE ROLE OF THE FEDERAL GOVERNMENT

Issue

Concern over the developments in biotechnology has been focused in three distinct areas: religious and philosophical considerations; possible environmental and health risks; and the impact of commercialization activities. While the extent of discussion of the first two areas has diminished considerably, commercialization still remains a topic of debate. In addition, the exact role of various Federal agencies (EPA, FDA, OSHA) in regulating the new technology remains to be determined.

Background

Public debate over the controversial issues in biotechnology began in the early to mid-1970s with the Gordon Conference on Nucleic Acids (6/73), the establishment of the Recombinant DNA Advisory Committee (RAC), by the National Institutes of Health (NIH) (10/74), and the Asilomar Conference on Recombinant DNA Research (2/75). Since the initial publication of the NIH/RAC guidelines (7/76) and their many subsequent revisions, concern over the safety of the research has gradually diminished. Ethical reservations have similarly abated.

Examination of the commercialization issue began somewhat later, in October of 1980, with the announcement by Harvard University of its plan to consider the formation of a biotechnology company. Concern reached a peak with reports of the $50 million agreement between Hoechst A. G. and Massachusetts General Hospital in May of 1981. Subsequently, a number of other contracts were announced, including: Harvard/Dupont, $6 million (6/81); MIT/Whitehead Institute, $127.5 million (12/81); and Washington University/Monsanto, $23.5 million (6/82).

Analysis

Some critics of the growing number of contracts between industry and the universities blame the Federal Government's declining support of basic research. The Administration has also been accused of contributing to the scarcity of Ph.D. scientists and engineers in this new technological area. For example, in 1978 a distinguished group of educators recommended that the National Science Foundation increase its competitive graduate fellowships in science and engineering from 500 to 2,000 per year. In 1981, the Administration completely eliminated new fellowships. Congressional action restored the number to 500. In 1982, the number of new fellowships remained at 500.

As recombinant DNA-manufactured products reach the marketplace, various Federal agencies will begin to become involved in their regulation. FDA will be approving new products on a case-by-case basis. Since the environmental risks of recombinant DNA are speculative at this time, EPA has not yet established any regulatory guidelines in this area. Should hazards emerge in the future, they probably can be handled under the Toxic Substances Control Act (TSCA) regulatory framework. Similarly, the Occupational Safety and Health Administration (OSHA) cannot propose permanent standards under the authority of the Occupational Safety and Health Act until a recognized occupational hazard has been determined.

DRUG REGULATION AND APPROVAL PROCESS

Issue

Drug regulation reform legislation was proposed during the 95th and 96th Congresses, but no similar attempt has been made in the 97th Congress to overhaul the drug approval process in the United States. The pharmaceutical industry continues to press for regulatory relief in order to stimulate innovation. Consumer groups argue that any deregulation of the industry (in the nature of a streamlined drug approval process) should not occur with a concomitant compromise of the statutes that require drugs to be tested for safety and efficacy prior to marketing.

Background

A few years ago the Food and Drug Administration implemented its "fast track" system for reviewing drug approval applications. The present Administration has announced its intent to modify the process even further by promulgating new regulations aimed at shortening the amount of time it takes to market a new drug. The major changes included in the Aministration's proposal are as follows:

- Permit the approval of new drugs based solely on foreign data;
- Allow for the submission of summaries of studies in order to reduce the bulk of paperwork;
- Allow for the importation of drugs for limited personal use only;
- Strengthen reporting requirements of adverse effects;
- Reduce unnecessary supplements to previously approved New Drug Applications (NDAs); and
- Generally shorten the review process as well as alter the appeals process in the FDA to resolve scientific disagreements more quickly.

Analysis

The FDA reported the approval of 27 "new chemical entities" in 1981, a considerable jump over the 12 new products approved in 1980. The number of approvals for 1982 should remain relatively high as well. At this time it is unknown what effect the new regulations will have on drug approvals in the future. Some organizations argue that the new proposals will weaken rather than strengthen the drug review process, and as a result leave consumers at risk.

While the Administration has been proposing regulatory change, the pharmaceutical industry has been actively seeking restoration of what it considers lost patent protection for its products. The industry explains that patent extention is necessary in order to stimulate future investment in drug innovation. Consumer groups point to the high profitability of the drug industry and argue that patent restoration is actually unnecessary, will lead to higher drug prices in the long run, and will block the generic drug industry from copying brand name products and being price competitive in the marketplace.

ALTERNATIVES TO USE OF ANIMALS IN BIOMEDICAL AND TOXICOLOGICAL RESEARCH

Issue

Numerous bills were introduced during the 97th Congress to accomplish various objectives in the area of animal rights, protection, and welfare. Most of the proposals were aimed at providing better protection of animals used in biomedical and toxicological research with an emphasis placed on trying to uncover methods of testing which reduce the need for live animals. One piece of legislation, the Humane Care and Development of Substitutes for Animals in Research Act (H.R. 6928), was reported by the Committee on Science and Technology on August 19, 1982 (House Report 97-777 Part 1).

Background

Animal welfare organizations complain that too many animals are used each year in either duplicative or unnecessary research and testing. These organizations want the Congress to enact new legislation or amend current statutes to implement a system to oversee the use of laboratory animals. At the same time they want the Federal Government to promote the development of alternatives to the use of animals in research. Limited alternatives currently exist; however, animal rights groups believe that more effort should be placed on trying to reduce, replace, and refine animal use when possible. On the other hand, researchers explain that only through the use of animal models can we further scientific knowledge and establish the safety of the products that will eventually be consumed by humans.

Analysis

The number of animals used in research each year continues to decrease, probably due to their expense and to the practice of using whenever possible non-animal methods which are less costly. It is doubtful that the use of animals in research can ever be completely eliminated because of the inherent necessity that products be tested in some organ system (usually mammalian) in order to make some prediction of toxicity, metabolism, deposition, and elimination from that system which then can be used to extrapolate to the human experience. At the present time, the general position of the biomedical research community and the regulatory agencies is that the alternative methods referred to by the humane groups, which advocate the elimination of animals from research and testing, are not yet suitable for obtaining all the data necessary.

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CURRENT STANDARDS FOR FOOD SAFETY AND LABELING AND THE PUBLIC'S HEALTH

Issue

During the 97th Congress, numerous bills concerned with food safety and labeling regulation were introduced. The changes proposed in these bills would have altered the existing regulation of foods that are shipped in interstate commerce. Although several congressional hearings were held, none of the bills were passed by either the House or Senate. Scientific and regulatory issues that surround the proposed changes in existing statutes will continue to be of concern to policymakers, consumers and food producers.

Background

The Pure Food and Drug Act of 1906 contained provisions on the adulteration and misbranding of food. In 1938 the Federal Food, Drug and Cosmetic Act (FD&C Act) became law, clarifying circumstances under which a food is considered adulterated or misbranded, and thus subject to FDA action. By mid-20th century the increased use of chemicals in all phases of food production and processing led to concerns about the safety of the food supply. Several food safety amendments were made to the FD&C Act: Pesticides, 1954; Food Additives, 1958; Color Additives, 1960; and Animal Drugs, 1968. The amendments were designed to prevent, where possible, harmful substances from being allowed in the food supply. Specific provision was made to ban the use of any food or color additive or animal drug demonstrated to cause cancer (irrespective of the dose) in man or animal (the Delaney clause). Beginning in the early 1970s, FDA initiated a policy to provide greater information to the consumer through food labeling. Most recently, FDA has proposed rules for the voluntary declaration of sodium content of foods and related labeling claims.

Analysis

While the FD&C Act, as amended, and related statutes have served well during the period since enactment, recent events have created doubts about applicability in future questions of safety and labeling requirements, and the appropriate role of Government in protecting the public as knowledge expands on diet and disease relationships. Certain scientific advancements in detection and animal testing procedures have occurred in the past 25 years. Also, techniques in the field of epidemiology have improved to enable the study of chronic diseases in humans relative to the exposure to certain substances. Despite the scientific advances of the last 25 years, however, there are still many unanswered questions.

The 98th Congress is likely to confront the issue of whether or not to change the existing food safety and labeling provisions of the FD&C Act, and the Federal Meat Inspection, Poultry Products Inspection and Egg Products Inspection Acts. The decision on this issue will rest, in part, on the evaluation given to certain related issues: risk assessment; strictness of the Delaney clause; administrative interpretation; and the role of Government to protect/inform the public.

NUTRITION RESEARCH ISSUES

Issue

During the 97th Congress, hearings were held which examined the Federal role in nutrition research. Specific attention was focused on the coordination of research efforts between the Departments of Agriculture (USDA), and Health and Human Services (DHHS). Additional concerns exist about the adequacy of research techniques to provide meaningful data and the appropriate role of the Federal Government in providing public information on nutrition.

Background

The role of the Federal Government in human nutrition research and public information was originally derived from the legislative authority which created the USDA in 1862, and was further clarified by the Research and Marketing Act of 1946. To accomplish this mission, USDA's research program through the years has been concerned with determining: 1) optimum nutrient requirements; 2) nutrient composition of foods; and 3) nutrient intake as influenced by food habits and food composition. These research efforts are currently carried out in six research centers located across the United States. To fulfill its charge to disseminate research results, USDA has in the past provided information through a variety of publications.

Within DHHS, human nutrition research is supported by several agencies. The National Institutes of Health support research and training in nutrition as it relates to health maintenance, disease prevention and treatment. The FDA program collects data for regulation of the nutritional quality and safety of the food supply. The Alcohol, Drug Abuse and Mental Health Administration conducts nutrition research as it relates to mental health, drug abuse and alcohol consumption. The National Center for Health Statistics gathers data for the Health and Nutrition Examination Survey. The Centers for Disease Control have a program which focuses on the development of methods for nutrition status monitoring and surveillance.

Analysis

Congress has expressed concern in the last two years over the Executive Branch's policy and commitment to human nutrition research and public information. Of particular concern have been recent actions which may represent a reduction in the Federal role and responsibility in these activities. Reorganization of USDA research efforts is viewed by opponents as a step toward a reduced level of visability and responsibility for achieving national nutrition research priorities. Restrictions have been placed on nutrient composition data which have been published periodically in scientific journals in the past. None of the events stated to implement a coordinated nutrition status monitoring system have occurred. Recent decisions have curtailed applied nutrition research necessary for policy and regulatory decisions as well as technology transfer to scientists and consumers. Defenders of these actions blame budgetary constraints, and support the need for user fees and transfers of certain activities to the private sector as appropriate.

During the 98th Congress, legislators may need to examine whether the existing mandates concerning human nutrition research and information are being fulfilled, and delineate more clearly the intent of the Congress with regard to 1) conduct of nutrition research, and 2) dissemination of public information.

HUMAN GENETICS: RESEARCH AND SCREENING ISSUES

Issue

In the past decade congressional interest has focused on the applications of genetic research, particularly on the hypothetical health risks of recombinant DNA. Recently interest has turned to possible human applications of the research, such as genetic screening and gene therapy. Genetic screens are used to identify carrier status in adults, as well as the presence of certain genetic diseases in the fetus. Industry is currently experimenting with the use of genetic screening as a pre-employment test and as a monitoring device in the workplace. Gene therapy, the replacement of a defective gene, may have potential for use in the treatment of single gene diseases (i.e., sickle cell anemia, thalassemia, etc.) There are many as yet unanswered ethical, legal, and scientific concerns surrounding new genetic technologies.

Background

Initial concern over public health risks from recombinant DNA research was expressed by scientists at the Gordon Research Conference in 1973. This led to the establishment of guidelines governing federally funded research by NIH's Recombinant DNA Advisory Committee. Through hearings, proposed legislation and reports Congress has focused its attention in this area, but no final congressional action has been taken. However, State and local governments have adopted ordinances regulating DNA research.

Genetic screening legislation began in the 1960's with State laws requiring mandatory screening of newborns for phenylketonuria (PKU) and was continued in the 1970's as 12 States enacted mandatory screening laws for carriers of sickle cell anemia. Sickle cell screening tests are intended to identify individual carriers of the sickle cell trait, and not to detect the presence of the disease. Inadequate counseling procedures resulted in confusion over the meaning of these tests and the social stigmatization of those found to be carriers. Recently, genetic screening has received limited usage in an occupational setting. This area will continue to be explored in the coming years.

Analysis

Genetic screens raise basic ethical concerns over the eugenic philosophy which opponents believe it promotes. These screens have potential to prevent the birth of genetically defective infants and the development of occupational disease. In the latter application, opponents are concerned over possible violations of worker rights, privacy rights, equal opportunity practices, guarantees of a safe workplace and the dissemination of test results. Proponents claim savings in insurance and health care costs, and therefore support continued research on the screening methods. They point to the dissemination of information to the employee as another benefit of screening. The usefulness of gene therapy as a practical means of curing genetic diseases has been questioned. The possibility of permanently altering an individual's heredity also raises ethical issues.

Policymakers continue to monitor the development of new genetic technologies in order to remain aware of potential problems and to prevent their occurence through oversight, regulation, and legislation, where appropriate.

HEALTH CARE RESEARCH AND THE ELDERLY

Issue

Since 1900, the percentage of individuals over 65 has been steadily increasing in the United States and this trend is predicted to continue well into the 21st century. While the elderly consume a greater proportion of health care resources than the rest of the population, the number of physicians trained in geratology continues to be a very small percentage of the medical profession. The White House Conferences on Aging have served to illustrate that both the Federal Government and the general public view the problems of the elderly as major issues of concern for the future of the United States.

Background

In 1900, 4 percent of the U.S. population was over age 65; by 1950 this percentage had doubled to 8 percent. In early 1980, it stood at 11 percent and is expected to reach 17-20 percent by the year 2030. The elderly comprised 10.8 percent of the population in 1977, but consumed approximately 29 percent of all health care resources that year. There are only about 140 geratology specialists in the U.S. medical profession, and medical students receive, on the average, only two course hours of instruction on aging per se in their entire 4 year curriculum. The senile dementias, including Alzheimer's disease (which accounts for 60 percent of all senile dementias), multi-infarct dementia (18 percent) and other causes (22 percent) currently affect between 2 and 4 million people in the United States. It is estimated that this number will increase by 50 percent during the next 25 years unless major advances are made in prevention and treatment of these illnesses. Long-term care of the elderly is also a growing national problem: 1.5 percent of the U.S. population betwen 65 and 74, 6 percent between 75 and 84, and 20 percent of those older than 85 are institutionalized in hospitals for the chronically ill or in nursing homes. Individuals institutionalized for longer than 6 months have little chance of being discharged.

Analysis

Though a large proportion of a physician's clientele may be elderly, he/she is likely to be unaware of this group's special social position and how it interacts with their disease process. The elderly are frequently not given the same attention, such as a thorough medical examination that is routinely given to a younger individual suffering from the same disease. Medical misdiagnosis may be correlated with society's failure to recognize the elderly as a diverse heterogeneous population with many different needs and common society-based problems: the tendency toward nuclear families which exclude the elderly and the high value placed on able-bodied working individuals.

In the past, research on health problems which primarily affect the elderly have been frequently neglected (for example, stroke, long-term care, the senile dementias and care of the dying). Researchers are beginning to believe that many of the changes commonly attributed to the aging process may in fact be due partially to physical inactivity. On September 20, 1982, the National Institute on Aging Laboratory of Neurosciences' clinical program admitted its first patients to a new unit in the Clinical Center. This marks the beginning of an intensive investigation of brain matabolism in normal human aging and in dementia. Also, this is the first time NIA has had space in the Clinical Center.

FRAUD AND ABUSE IN RESEARCH

Issue

Congress and the general public have become increasingly concerned about reports of fraud and abuse in research. Although scientists state that such instances are rare and easily discovered, the number of cases reported and the high caliber of the research institutes involved have caused critics to speculate that fraud may be widespread throughout scientific research.

Background

Two types of research misconduct have generally been cited. Fraud in research reporting can be either plagerism of another scientist's work or direct fabrication of research results. An example of known fraudulant research would be that of Dr. John R. Darsee at Harvard. A second form of misconduct, the unethical use of human subjects in biomedical research, would involve not only the improper treatment of patients but also the use of experimental therapy on humans before the required animal studies had been completed and reviewed. An example would be the clinical trials reported by Dr. Martin Cline of UCLA. In response to such incidents the National Institutes of Health (NIH), the Association of American Medical Colleges (AAMC) and various universities have developed or are in the process of developing guidelines to prevent such incidents in the future, as well as procedures to deal with misconduct when it does occur.

Analysis

The growth of the scientific research community since World War II has produced not only impressive new knowledge but qualitative and quantitative changes in science itself. Specialization has decreased the ability of reviewers to critically evaluate work peripheral to their own. Many research groups tend to be large and the lab director cannot be thoroughly competent in all the represented subspecialities. In addition, graduate and post-doctoral students are under increasing pressure to produce publishable results in order to attain a suitable research position. The lab director is under similar pressure to publish papers before a grant or project is up for review. Anxiety over limited Federal research support may also be a contributing factor.

The following guidelines have been suggested in order to guard against charges of misconduct in the future: encourage evaluation of young scientists on the basis of quality rather than quantity of research; written detailed procedures for data gathering, storage, and analysis should be available in the lab; regular in-depth scrutiny of primary data and calculations by the laboratory director is advised; and research results should be repeated by different teams with the same lab, if possible. On the national level, the responsibility of the institution discovering dishonesty in research to other institutions, to the scientific and medical community and to the public at large remains to be determined.

X. MATERIALS R&D AND RELATED POLICY

MATERIALS RESEARCH RELATED TO NATIONAL DEFENSE STOCKPILING

Issue

The National Defense Stockpile was established to insure that the Nation would have an adequate supply of strategic and critical materials in time of a national emergency. Planning and acquiring the amounts of various materials to be held in such a stockpile is predicated on a complicated contingency analysis to predict the amounts and types of material to be needed. Truly adequate supplies of materials can only be ensured if substitutes can be developed for the materials declared to be critical and strategic, yet the Federal Government may not now have a materials R&D program that can effectively attack the need for such substitutes.

Background

The need to maintain secure supplies of materials that are vital for national defense but not domestically available has been formally recognized by the Government since World War I. World War II prompted the emergency management of a great variety of materials, and the accelerated development of substitutes for materials that were in the shortest supply or totally unavailable—butyl rubber being one example. Post World War II, Congress and successvie Administrations have made a concerted effort to create and maintain an effective stockpile for national defense. The current arrangement provides for the administration of the National Defense Stockpile by the General Services Administration under the planning and direction of the Federal Emergency Management Agency, which is responsible to assess U.S. needs in the event of conflict. However, whatever stockpiling provisions are made, it is generally agreed that the national security will be best protected if substitutes can be found for those materials classed as strategic and critical. The point at issue is whether the Federal Government (1) has the information needed to assess whether an adequate effort is being made by industry and/or Government to find such substitutes and (2) is attempting to maintain a vigorous R&D Program to ensure that adequate substitutes are being developed.

Analysis

In spite of strong recommendations from a succession of study groups since World War II, the Federal Government has not yet established a continuing information system that could be used to evaluate the need for materials development. Under the provisions of the National Materials and Minerals Policy, Research and Development Act of 1980, the OSTP has established a Committee on Materials (COMAT) to collect necessary information from Federal agencies to perform an overall assessment of what materials research is underway under Government sponsorship. However, many problems remain to be solved in collecting this information in usable and consistent form for the required analyses. Following these analyses, a number of problems will be encountered in coordinating Federal materials programs to focus on strategic materials problems in addition to their individual current goals. It might be appropriate in the 98th Congress to examine the effectiveness of the current COMAT effort in OSTP in gathering information, to obtain an overview of those Federal R&D programs that now focus on the strategic stockpile, and to examine what legislative initiatives might be taken to ensure that strategic materials development becomes a definite goal of all appropriate Federal materials programs.

SECURITY OF MATERIALS SUPPLY/ENHANCED DOMESTIC PRODUCTION

Issue

While pursuing the benefits of international trade, the United States has become increasingly vulnerable to potential supply disruptions of strategic and critical materials which could lead to economic impacts that may require severe adjustments for businesses whose supply chains are dependent on these materials. The most secure source of materials is domestic production. However, increasing security of materials supply through enhanced domestic production is a complex issue related, in part, to the economics of international trade and research and development in minerals exploration, mining, and processing.

Background

The United States is becoming increasingly dependent on imports of strategic and critical materials. This condition is likely to be a contributing factor of industrial uncertainty, economic instability, and unfavorable balance of trade, contributing to further consequences such as inflation, unemployment, wide price fluctuations in materials, and shortages of investment capital. There are two categories of issues dealing with security of minerals supply: short-term issues which are generally politically dominated and involve the defense aspects of vulnerability, such as strategic stockpiling; and long-term issues which are economically dominated and have to do with competition in international trade, economic stockpiling, and the fostering of new technologies to strengthen the domestic economy and enhance U.S. ability to compete in trade.

Analysis

Congress may wish to examine how a healthy, efficient, domestic materials-producing industry can be maintained while assuring adequate supplies of materials at prices established in competitive world markets. What is the effectiveness of, and what are the incentives for, various possibilities for alleviating materials dependency such as scrap recovery and recycling, substitution, reduced usage or private stockpiling? What are the fertile areas for research to enhance domestic minerals production, such as the use of remote sensing in exploration, development of nonconventional mineral extraction technologies, and improved beneficiation?

MATERIALS SUBSTITUTION, CONSERVATION AND DISPOSAL R&D AND POLICY

Issue

Rising energy costs, and possible energy shortages, make it necessary to seek ways to conserve materials which are energy-intensive to produce, to substitute materials requiring less energy in their production for those that are now used, and to seek ways to recycle disposed materials. The question is whether current economic incentives favoring substitution, conservation and recycling are fostering a healthy amount of R&D in such possibilities in the private sector, and whether Federal programs focusing on these topics need to be expanded, sustained, or reduced as a result.

Background

Rising energy costs have profoundly changed the economics of the materials industry, especially the profitability of many materials manufacturing processes. Increasing scarcities of many basic resources exacerbates this general problem further, though it is often possible to substitute new, or less rich, ores and raw materials for those which have become scarce—but often only at the cost of increasing the energy intensity of the production processes involved. Thus energy costs tend to have many indirect, as well as direct, effects on materials economics and on production generally.

Materials substitution, conservation, and recycling offer the most attractive avenues for avoiding the consequences of higher energy prices and outright shortages of raw materials. However, the incentives of current prices of raw materials and of energy may not be sufficient to promote the level of R&D and implementation in these three areas that could turn out to be needed in the event of a future disruption in supplies of fuels and/or raw materials.

Analysis

Though the economic pressure of higher prices may prompt the development and adoption of materials substitutes as necessary, and promote the conservation of scarce materials and the recycling of materials, it may prove expensive to introduce such changes. Certainly one component of the inflationary pressures that exist today is the increased price of materials, yet the price increases in finished goods is only partly attributable to the rising cost of materials. Thus the pressures for substitutes, conservation and recycling may not be strong enough for manufacturers to change current methods without Government intervention.

Appropriate questions for examination might include (1) the level of activity in R&D for materials substitution in industry and in Government, (2) the conscious efforts, if there are such, in industry to reduce waste in the production of materials from raw material resources and to reduce waste of manufactured materials in later production stages, and (3) the R&D devoted to collection and separation of discarded materials for reclamation and recycling.

THE FEDERAL ROLE IN MANAGING MATERIALS AND MINERALS INFORMATION

Issue

A national materials information system that is accurate, complete and coherent is believed necessary for improved collection, analysis, and dissemination of scientific, technical, and economic materials and minerals information.

Background

Comprehensive management of materials information became feasible as a result of widespread development of electronic computers in the 1950's. Today, a large number of independent materials information systems exist in the public and private sector. These vary widely in terms of accuracy, currency, accessibility, completeness, format, and emphasis. Lack of coordination and uniformity among the various information systems limits their usefulness to Federal decisionmakers in establishing public materials policy, particularly with respect to predicting materials shortages, and assessing minerals supply and demand. In light of these shortcomings, there is a perceived need for Federal action that will bring some degree of order and cohesion to the collection, analysis, and dissemination of materials information and data.

Analysis

Many questions are raised as to how, and if, a national materials information program should be implemented. Should it be established within an existing agency, or should it be autonomous? What should be its capabilities and services? These could include: information referral, monitoring, coordinating, evaluating, and improving existing systems; analyses and forecasts that could provide an "early warning system" for potential shortages; foreign and domestic mineral inventories; or perhaps the incorporation of existing materials information systems into one comprehensive centralized data base. Also, how much (if any) authority should a materials information center possess over other Federal agencies and private industry in order to enact its programs? And finally: considering the cost and bureaucratic complexities of establishing a national materials information entity, could the systems already in place be improved on a case-by-case basis without the direction of a centralized coordinating body?

COUNCIL ON CRITICAL MATERIALS

Issue

Concerns have been raised over how national materials policy should be coordinated on the Federal level. Specifically, which institutional mechanism is best suited to implement the policies of the National Materials and Minerals Policy, Research and Development Act of 1980 (P.L. 96-479)?

Background

The Materials Policy Act of 1980 specifies that national materials policy and decisionmaking be conducted through the Executive Office of the President. Additionally, the Act suggests that materials research and development analysis be performed by the Office of Science and Technology Policy.

The Administration, in its National Materials and Minerals Program Plan to Congress, states that national materials policy will be coordinated through the Cabinet Council on Natural Resources and Environment, which is operated through the Office of the Secretary of the Interior. Also, the interagency Committee on Materials (COMAT) is designated as the Federal research and development coordinating body.

Congress has responded with proposed legislation that would establish a permanent three-person Council on Critical Materials within the Executive Office of the President. The proposed Council would: 1) coordinate critical materials policies, including R&D, among various agencies and departments of the Federal Government; 2) increase awareness of critical materials issues among Congress, the President, and the public; and 3) establish an on-going dialogue with the private sector concerning materials policy issues.

Analysis

The Administration argues that the Council on Critical Materials is unnecessary, because existing organizational mechanisms satisfactorily coordinate national materials policy. Consequently, it is felt that the Council would bureaucratically impede materials and minerals policy coordination, whereas the Cabinet Council on Natural Resources and Environment, already in place, fulfills the policies and principles set forth in P.L. 96-479.

Supporters of the proposed Council claim that national materials policy, set by the present Cabinet Council within the Department of Interior, will focus excessively on minerals, mining, and related public land policies at the expense of issues like materials processing, substitution, and recycling. They assert that policymaking at the executive level is necessary to transcend interagency competitiveness and bias. Also, the establishment of a permanent coordinating body in the Executive Office could assure continuity of materials policy from one Administration to the next.

MATERIALS PROCESSING R&D NEEDS

Issue

The American manufacturing industry faces stiff competition from foreign competitors some of whose governments subsidize extensive materials processing R&D and modernization programs. Of particular concern is the steel industry, which a recent study found to be more outmoded technologically than any other major American manufacturing industry.

Background

Before 1950, the American steel industry supplied over half of the world's raw steel. Today, it accounts for only about 15 percent of world steel output, and the Nation must import nearly one fifth of the steel it uses. Many believe that intensive efforts to identify, develop, and implement new and innovative steelmaking technologies are necessary to help revive the American steel industry. Ideally, such technologies should: consume less energy, allow the use of cheaper raw materials, require fewer personnel in operation and maintenance, produce less environmental pollution, and meet more stringent product specifications. To meet these requirements, state-of-the-art technologies such as continuous casting and computer control can be applied. Additionally, experimental technologies such as coal-based direct reduction of iron ore and plasma arc steelmaking, while high-risk and long-term in nature, offer the possibility of substantial payoff.

Analysis

It is estimated that a capital investment of $4 billion per year is needed to modernize the steel industry so that it can compete effectively in world markets. Presently, the industry can afford only $1 billion per year for capital investment. Should Federal funds be used to help revitalize the industry?

Proponents point out that foreign competitors are subsidized by their respective governments, and that major steelmaking innovations can be adopted domestically only if the Federal Government will: support basic research in steelmaking, provide incentives for more industry R&D, and assist in pilot and demonstration projects.

Those opposed to direct Federal aid maintain that accelerated cost recovery tax programs and deregulation will enable the industry itself to generate the capital necessary for enhanced R&D. They note that the U.S. steel industry is the world's second largest, and that it still supplies the bulk of the world's largest national market.

REVITALIZATION OF THE DEFENSE PRODUCTION ACT

Issue

The United States continues to depend heavily on imports of strategic and critical materials, a cause of concern to national defense planners and uncertainty to domestic materials producing, processing and fabricating industries. Measures such as the Defense Production Act could be enhanced or more fully utilized to help mitigate this situation.

Background

During the Korean War demand for basic materials accelerated and there was increased ugency to build up stockpiles of strategic and critical materials. In response to this sense of urgency, Congress passed the Defense Production Act in the summer of 1950. The Defense Production Act was a preparedness measure reflecting recognition that expansion of many domestic minerals and metals-producing industries would require Government assistance. As originally enacted the Defense Production Act authorized the President to institute and maintain a number of economic programs to improve the readiness of the Nation's industrial base and prepare for national defense mobilization. The three titles of the Defense Production Act remaining in force currently provide the principal basis for the development and maintenance of the Nation's defense industrial preparedness. The Defense Production Act has a long history of short extensions, the most recent being a six-month extension until March 31, 1983.

Analysis

Concern has been raised that certain provisions of the Defense Production Act are outdated and in need of revision. Many of these concerns were addressed in the Defense Industrial Base Revitalization Act (H.R. 5540) which was considered on the House floor in August and September 1982, but no resolution was reached. Congress may wish to renew examination of the provisions of the Defense Production Act to assure that defense needs and strategic and critical materials concerns are adequately addressed. It there need to revise the National Defense Stockpile management and resources planning process? What funding level would be appropriate for the Defense Production Act? Is better coordination of minerals information and materials research and development programs needed? Could such coordination be better accomplished through an independent materials council

Concern has also been raised over the history of repeated extensions of the Defense Production Act for periods ranging from 15 days to 2 years. Congress may wish to examine the advantages of enacting a longer period of extension, of perhaps 5 years, in order to provide greater continuity and a more secure mandate.

STRUCTURAL FAILURE R&D AND TECHNOLOGY IMPROVEMENTS

Issue

Structural failure of buildings, dams, and other man-made structures—whether it occurs under the influence of earthquakes or other unusual occurrences or not—poses a risk that should be reducible with improved materials and engineering. The question at issue is whether the United States has a well-coordinated and extensive R&D program to examine the causes and cures for structural failures.

Background

Structural failures pose a social risk that are—to some degree—similar to the risks of nuclear accidents in terms of their sudden, and at times highly unpredictable, occurrence and extensive lethality. It is not uncommon for dam failures to result in hundreds (sometimes thousands) of fatalities. And while other structures, such as bridges and large buildings, rarely fail without warning under normal use, they can inflict severe damage and destruction under stress of wind or earthquake. Less dramatic failures occur fairly frequently in structures as a result of the slow processes of decay that result from corrosion, repeated flexing and "working," and similar processes. These failures from slow processes cost billions of dollars each year in repair or replacement expenses. Not only buildings, bridges, and other such structures are involved, but also structures such as highways, railroad beds and rails, and city water and sanitation facilities are constantly being weakened to the point of failure. These latter structures pose major problems and expenses for the current decade.

Analysis

Though a great deal of research in the United States relates, or would be useful, to efforts to reduce structural failure, considerable improvement may be possible. For one thing, structural failure is the focus of attention of only a few R&D programs sponsored by the Federal Government (with the exception of aeronautical R&D), most notably the relatively small program on earthquake hazards at NSF and the buildings programs at NBS. There is no major overall effort to focus attention on topics such as corrosion inhibition or to improve materials suitable for structural uses so as to reduce failures. There would seem to be little mathematical analysis of structural failure, perhaps for lack of Federal support programs aimed at solving that specific problem. It therefore seems appropriate to examine the extent of R&D that is aimed at structural failure, and the other research being sponsored that is related and might contribute more directly under better coordination of agency programs to learn what improvements can be made.

CRITICAL MATERIALS IN THE AEROSPACE INDUSTRY

Issue

The aerospace industry in the U.S. relies heavily on the availability of certain critical materials imported from politically unstable regions of the world.

Background

Only a handful of materials satisfy the high performance needs of aerospace technology. Aircraft propulsion systems require materials which have extremely high melting points, and which resist strongly corrosive environments. Airframes require light-weight materials of very high strength.

The U.S. has a high import dependence on many of the minerals that fit these high performance criteria. These include: cobalt (93 percent import dependence), chromium (91 percent), columbium (100 percent), and tantalum (90 percent). Both cobalt and chromium are imported primarily from southern Africa, and there are concerns that a cut-off during a national emergency could cripple the defense industry and endanger national security. There are also concerns that price fluctuations caused by periodic supply disruptions, or the formation of cartels, could damage the economic health of the aerospace industry, which is the nation's number one manufacturing exporter.

Analysis

Among the questions and concerns raised are: In defense contracting, should advance procurement funding be increased to allow the aerospace industry to obtain greater amounts of critical materials at present levels of price and availability? Has adequate data been collected, by either government or industry, which would allow accurate assessments of future critical materials availability and usage? Should the National Defense Stockpile be used only for military purposes, or should it be available for industrial commercial use? And, should government provide more funding for R&D programs aimed at finding substitutes for critical and strategic materials used in aerospace technology?

FIRE PREVENTION AND CONTROL TECHNOLOGY

Issue

Improved fire prevention technology can reduce loss of life and property due to fires in the U.S. To what extent is a Federal focus on fire necessary to stimulate the kinds of fire prevention R&D efforts which are required?

Background

The United States has the highest per capita death and property loss fire rate of all industrialized nations. In 1981 alone, fire in the U.S. claimed 7500 lives and accounted for $6 billion in direct property losses. Spurred by recommendations of the 1973 National Commission on Fire Prevention and Control report entitled, "America Burning," Congress passed the Federal Fire Prevention and Control Act of 1974 (P.L. 93-498). This law created the United States Fire Administration (USFA), which would provide a national focus for the nation's fire problem through programs geared towards education and training, a national fire data center, and research and development in fire sciences and engineering. Since 1974, the number of fire-related deaths in the United States has fallen from 11,600, to the current level of 7500.

Today, R&D efforts deemed particularly important are those aimed at solving current problems; such applied technologies include a "protective envelope" for fire fighters, and the improvement of residential sprinkler systems. Basic research is also being performed in areas such as: fire toxicology, materials fire properties, and fire growth processes. Additionally, there is a significant emphasis on anti-arson research and training.

Analysis

The Administration has proposed eliminating the USFA, and redistributing some of its programs within the Federal Emergency Management Agency (FEMA). Those in favor of this action point to a "significant decrease" in the loss of life and property due to fire. They maintain that programs such as the National Fire Academy will remain intact within FEMA, and that other USFA programs, including certain R&D projects, can be transferred to the private sector and to local communities.

Opponents of the proposed elimination of USFA assert that direct Federal participation is crucial for the continuation and initiation of important R&D programs. They stress that the nation's fire problem requires a separate and identifiable agency within the Federal Government which will commit its total resources to assist the existing fire protection community.

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XI. SOCIAL SCIENCE RESEARCH

SOCIAL INDICATORS RESEARCH

Issue

Since the Administration has cut back or terminated many social statistics data efforts, oversight may be required of the Nation's capabilities in these areas. What may be required is examination of the National Science Foundation's (NSF) and other agencies social data and social indicators research programs in relation to the Census Bureau's publication series on Social Indicators and statistical data collection efforts in other agencies. Consideration might be given to reviving the proposal to create a Council of Social Advisors. Consensus is needed to determine whether indexes can be developed.

Background

The NSF has supported a social indicators research program for over ten years and awards considerable continuing funding to the Social Science Research Center to support a clearinghouse and research advisory mechanism. The Federal statistical data system, managed by the Census Bureau, manages the Federal data collection effort. These efforts have been cut back by the Reagan Administration.

Analysis

Important questions regarding social indicators research include: Is there adequate cross-fertilization between research and data production efforts in different agencies? Should the Federal Government do more to generate public opinion data on quality of life? Is that a proper Government function? Can social indicators be used for program evaluation purposes? Should the Congress revive its inquiry into creating a Council of Social Advisors, like the Council of Economic Advisors in the White House? Is it feasible to develop social indicators, like economic indicators, to provide policymakers with a quick measure index of changes in quality of life and social conditions? Should indicators efforts continue to focus on intolerability thresholds in various areas, or aspire to measuring more abstract and positive indicators of some marginal aspects of quality of life, such as aesthetics, happiness, job satisfaction, etc? Do impact data requirements cause needless paperwork burdens?

IMPLICATIONS OF REALIGNING FEDERAL SUPPORT FOR SOCIAL AND BEHAVIORAL SCIENCE RESEARCH IN NSF AND OTHER AGENCIES

Issue

The Reagan Administration's FY 1981, FY 1982, and FY 1983 budgets made major realignments and cuts in behavioral and social sciences research programs. The basic issue is: will cutbacks in Federal support for behavioral and social sciences research hurt development of these disciplines, or will the hiatus in funding provide a time for reassessment of the purpose, progress, and utility of Federal funding for research and training for these sciences?

Background

The Reagan Administration's FY 1981, FY 1982, and FY 1983 budgets made major realignments and cuts in behavioral and social sciences research programs. Calculations, based on figures collected by the National Science Foundation, show that Federal funding for research in social sciences decreased 24.1 percent from FY 1980, when funding totaled $523,811,0000, to FY 1983, when funds are estimated at $397,778,000. Federal funding for psychological sciences increased 29 percent over the period from FY 1980, when funding totaled $199,009,000 to FY 1982, when funds are estimated to total $257,986,000. However, major realignment occurred in Federal support patterns for psychology research between the fiscal years 1980 to 1983. Consistent with increases overall in defense research, funding for psychological research by the Department of Defense increased 66 percent, from $63,552,000 to $105,333,333, the largest increase in funding for psychology registered by any agency. However, support by the National Science Foundation for research in psychology decreased 27 percent over this period, from $13,496,000 in FY 1980 to $8,621,000, in the fiscal year 1983.

Analysis

The fiscal year 1982 budget called for significant reductions of federally funded programs in the behavioral and social sciences in most Federal agencies, on the grounds that these programs were "low priority," not critical, or would contribute little to economic recovery. Because the cuts for behavioral and social sciences research were disproportionately larger than for other areas of science, except for the cuts in science education, some observers have charged that the proposed cuts were ideologically motivated, that is, the Administration views social scientists as liberal social reformers or biased advocates of social change. The National Academy of Sciences issued a report describing the utility to society of major social science breakthroughs. However, some critics continue to question the utility and relevance of some of the subjects encompassed by these disciplines. Some of the funding reductions were restored due to lobbying and congressional opposition. Some outstanding issues are: Should social scientists seek more support from foundations, the private sector, and industry? Since fewer proposals are being submitted now that Federal funds have been cut, does that mean that social scientists are seeking funding elsewhere or that a marginal excess of poor quality work is being withheld? Is the supply of behavioral and social scientists excessive? Should such scientists diversify employment prospects? Is it correct that biological and biochemical factors are more important causes of deviant behavior than behavioral and social factors?

HUMAN FACTORS IN INDUSTRIAL INNOVATION AND PRODUCTIVITY

Issue

Concern over the apparently diminishing U.S. lead in technological innovation has led to an examination of possible causes for this decline. Some feel, however, that insufficient attention has been focused on the part human resources play in innovation and productivity. Recently attention to the impact of human factors has grown along with that devoted to economic and technical factors. At issue is what the Federal Government in this area, and what can the Government do to assist the worker to be more efficient.

Background

The term "human factors" relates to those elements of the innovation process which involve management, labor, and their interrelationships. They are the components which contribute to improved human resource development, the nontechnological aspects of innovation which allow the worker to be more effective. Consideration of the human factor is an attempt to understand and improve the employee's interaction with technology, so that both the technical and human concerns of the industrial enterprise can be integrated to achieve increased productivity and innovation.

The human factor is perhaps the least understood facet of innovation. In the United States, little time and attention have been devoted to this subject. This is in sharp contrast to Japan where the employee is considered the most valuable resource in the innovation process. Similarly, studies have found that the most innovative companies in the United States tend to be those that recognize the value of human resource considerations. The human factor is so important because, ultimately, it is the employee who must apply new techniques in the workplace. New products and processes are ineffective in engendering increased productivity if they are not accepted and used by the workers.

Analysis

The Federal Government lacks a focus for innovation and productivity activities. There is no legislative mandate for an organization to take lead-agency responsibility in this area. Some have suggested that legislation be passed which provides organizational responsibility for innovation and productivity issues while simultaneously avoiding the impression of centralized Government planning.

The Government may be in a position to assist research into human factors, innovation, and productivity. This could include research on new approaches which cut across industries and which would not be undertaken by individual companies. It should be noted that P.L. 97-34, the Economic Recovery Tax Act, specifically exempts social science research from the qualified expenditure eligible for tax credits. It is possible that permitting tax credits for work in the social sciences would augment the efforts to understand the human resource components of innovation and foster the utilization of the resulting knowledge.

XII. SPACE R&D

U.S. SPACE POLICY

Issue

Despite attempts by President Carter and President Reagan to elucidate U.S. space policy through the issuance of policy directives, there continues to be concern that the United States does not have an adequate space policy to maintain U.S. leadership in this area, particularly in light of growing international space activities. There is special concern that U.S. policy has shifted to an emphasis on military rather than civil programs, and that NASA is spending too much on activities which directly support DOD.

Background

During the 25 year history of space activities, U.S. space policy has been based on the 1958 National Aeronautics and Space Act (NASAct) which created NASA to conduct civil space activities, while military space programs remained under the jurisdiction of DOD. The 1961 decision of President Kennedy to commit the nation to landing men on the Moon by the end of the decade set the course of the space program for the rest of that decade, but after the Apollo program ended in 1972, a feeling developed in the country (particularly among those directly involved in aerospace fields), that the country had no definitive policy on which to base its decisions on future space activites.

In 1978, in response to these concerns, President Carter issued two space policy directives. The first addressed the relationship between the military and civil space programs, while the second specifically discussed goals for civil space activities. These policies were criticized by many for being too general, and legislation was introduced in Congress to identify specific programs to be pursued. None of the legislation was reported from committee, however.

In 1982 President Reagan issued his own statement on space policy, discussing military and civil programs together.

Analysis

Despite these attempts to clarify U.S. policy, questions continue to arise about whether that policy is adequate to maintain U.S. leadership in space technology. An increasing number of countries are developing their own satellites and/or launch capabilities which will directly compete with the United States. This has become particularly evident in the case of launch vehicles, where the U.S. space shuttle is competing for business with the European Space Agency's Ariane launch vehicle.

The Reagan policy also raised questions abou whether the focus of U.S. space activities will be on military or civilian programs, since the first stated goal is support of national security requirements. The rise in expenditures for military space activities (they now exceed NASA's total budget), coupled with the perception that a substantial amount of NASA's space budget (primarily that associated with the space shuttle) directly supports DOD, has prompted concern that U.S. policy has shifted emphasis to military space programs.

SUPPORT FOR SPACE SCIENCE ACTIVITIES

Issue

The past decade has seen a decline in the level of activity in the space science area, based partially on the overall decline in NASA's budget and partially on the large funding requirements for the space shuttle. Criticism of the decline has become more vocal in space science programs as the lack of support for space science in the 1970's is emphasized by few space science launches now. Cutbacks by the Reagan Administration resulted in the cancellation or deferral of all but one planetary program (Galileo) and one earth orbital scientific program (Space Telescope).

Background

Since the beginning of the space age, a large number of spacecraft have been launched to investigate the Earth's atmosphere, the interplanetary medium, other planets, and to study the universe. These spacecraft provide information which aids in understanding the Earth as a planet through comparative planetology, analyzing how the Sun affects communications, weather and climate, and provides a greater knowlege of the stars and the universe.

Space science was given a relatively low priority within NASA as the agency's budget declined and funding demands for the space shuttle grew. Space science advocates hoped that as the shuttle placed fewer demands on NASA's budget in the early 1980's, new projects could be started, but shuttle funding continues to consume a large part of NASA's budget, and now NASA is proposing to initiate a space station project. NASA conducted a special study of planetary missions in an attempt to develop ways to continue planetary exploration with reduced budgets. The recommendations of this Solar System Exploration Committee were released in the fall of 1982 and focussed on sending a greater number of smaller (and therefore less expensive) spacecraft than had originally been planned to the planets, comets and asteroids.

Another aspect of the problem is funding for operations, research and analysis of the data returned by planetary probes, and continuation of programs after their primary missions are complete. For example, in programs such as the Viking spacecraft that landed on Mars in 1976 space scientists were concerned that inadequate financial resources were being provided to analyze the data. At the same time, NASA decided to turn off several planetary probes which had completed their primary mission, but continue to return data (such as Pioneer 10 which successfuly encountered Jupiter in 1974 but is still sending back data on the interplanetary medium as it heads out of the solar system).

Analysis

In its deliberations on NASA's annual budgets, the Congress may want to assess whether space science programs are receiving adequate funding, both for new program starts and for continuing analysis of data that has been returned. NASA is expected to request a new start for a Venus Mapping Mission in its FY84 budget, the first planetary new start in several years. Congress may also wish to review the recommendations of NASA's Solar System Exploration Committee regarding priorities for solar system exploration for the rest of the century.

GOVERNMENT SUPPORT FOR SPACE RESEARCH AND DEVELOPMENT

Issue

A continuing debate has emerged concerning whether the Federal Government or the private sector should fund advanced research and development for space systems. The question first arose with regard to communications satellite R&D, but has spread to other areas of applications as well (such as remote sensing).

Background

In 1973, President Nixon discontinued NASA's major R&D efforts in the communications satellite area. The reason cited was that the commercial communications satellite industry, rather than the taxpayers, should finance advanced communications satellite R&D. Private industry claimed, however, that it could not afford such expensive R&D efforts. By 1979 it had become evident that the research would not be conducted by the private sector and the United States was beginning to lose its competitive edge in this technology to other countries. As a result, NASA reentered the field. In 1981, President Reagan decided that the private sector should perform these R&D tasks and cancelled the NASA program. In 1982, Congress provided funding for NASA to pursue advanced communications satellite R&D and it is expected that the Reagan Administration will support this activity in the future. Nevertheless, with the changes in U.S. policy regarding this technology, there are concerns that the United States has fallen far behind countries like France and Japan.

The philopophy that the private sector should fund advanced R&D for applications program has extended to other programs as well, especially to the Landsat program of remote sensing satellites. The Federal Government has launched four of these satellites and plans to launch only one more -- subsequently, the future of the program will be in the hands of the private sector. Once again, however, the private sector appears unwilling to take on the task, particularly since there is no proven market for remote sensing products. Meanwhile, other countries (notably France) are planning to launch their own remote sensing satellites based on advanced technology which may reduce the demand for U.S.-generated remote sensing data.

Analysis

The role of the Federal Government in performing R&D is a continuing area of controversy. There are programs which might be deemed in the national interest to pursue at Government expense in order to maintain the competitiveness of U.S. technology with other countries, and others (such as public service communications) which may be of sufficiently great benefit to the populace that they warrant Federal expenditures. High technology ranks second only to agricuultural products as the most successful U.S. export. Thus, U.S. loss of leadership in space technology becomes significant in balance of payments considerations. In addition, the effect which the lack of consistent Federal commitment to high-risk space technology R&D has on the appeal of space applications programs to private industry is also important.

MANAGING AN OPERATIONAL SPACE SHUTTLE PROGRAM

Issue

The space shuttle made its first operational flight in November 1982. How the operational space transportation system should be managed, and what organization, inside or outside of the Federal Government should do it, is of continuing concern to the Congress, NASA, and potential users of the system.

Background

NASA estimates that eventually there will be as many as 24 space shuttle launches per year. These routine shuttle operations will place extensive demands on whatever organization manages the system. NASA has never before managed an operational system of the nature of the space shuttle, and such a large program would undoubtedly impose new organizational and management requirements within the agency. NASA has been developing a comprehensive shuttle operations management implementation plan for several years, and one possible approach is for NASA to retain overall shuttle management but to contract for launch and payload operations. Another option is for NASA to retain operational control over the shuttle for governmental launches, but have a separate government organization or the private sector operate the shuttle for non-government launches. Among the government organizations being considered would be DOD, user agencies such as the Departments of Commerce or Interior, or perhaps a new organization created specifically for this purpose.

Analysis

The space transportation system has already begun operations, making questions concerning its operational management structure of immediate concern. During the 98th Congress, consideration will be given to NASA's plans for shuttle operations as well as any other proposals which may be advanced for alternative shuttle management possibilities which might require legislation. The operation of the space transportation system is a large task and, whatever mechanism is chosen, the decisions made at this point will have ramifications which will impact the entire civilian space program in terms of costs of operations, launch scheduling and availability, and transfer of space benefits to the user community.

SHUTTLE UTILIZATION AND USER NEEDS

Issue

The space transportation system (STS) was designed to make routine space operations economical based on the shuttle's reusability and its benign launch environment. However, realizing these economies will depend on achieving a high level of shuttle utilization. Whether this expected utilization materializes or not, how utilization is being encounraged by NASA, and how user needs are integrated into the shuttle program are areas of concern.

Background

During the 1970's, NASA's planning for the shuttle revolved around a mission model of 560 shuttle flights during an anticipated 12 year operational period using a fleet of five orbiters. Questions arose during this time as to whether that level of utilization would be sufficient to require five orbiters and, in 1978, President Carter decided to approve the construction of only four orbiters. Congress has provided funding for long lead items for a fifth orbiter, but not for production.

At the same time, the number of anticipated flights has decreased. In 1982, NASA issued its latest mission model, showing 311 flights between FY83 and FY94. All but 18 of these flights already have scheduled payloads (although tne cargo bay could accommodate additional payloads on many of these flights). Thus, debate continues as to whether there is a need for a fifth orbiter. If NASA or private industry decides to construct space stations, thus requiring multiple space shuttle launches, additional launches may be required.

Predicted shuttle economies will only occur if maximum utilization is made of the shuttle and it replaces expendable launch vehicles (ELVs). NASA must find paying users in sufficient numbers to utilize the shuttle economically. Concurrently, however, users must be convinced of shuttle reliability and availability before they will make long term plans for utilizing the shuttle, and must be assured prices which are competitive with ELVs, both domestic and foreign. Several private sector groups are convinced that customers will want ELVs into the 1990's both because in some cases an ELV launch might be less expensive than the shuttle, and because the shuttle may be fully booked. Proposals have been made by these groups to either develop their own ELVs, or to market existing ELVs (such as Delta or Atlas-Centaur) as NASA phases them out.

NASA has studied mechanisms to broaden user interest, and has conducted symposia to reach potential uysers in industry and the scientific community. It has also established a system of "joint endeavor" agreements with industry to foster development of new uses of space, such as materials processing.

Analysis

A wide range of issues will face the 98th Congress concerning shuttle utlization, including: whether to build a fifth shuttle orbiter, factors which may affect shuttle turn-around time, NASA's activities with regard to attracting commercial users and considering user needs in developing the shuttle and associated upper stages, and whether to support development of a space station.

TRANSFER OF LANDSAT AND METEOROLOGICAL OPERATIONS TO THE PRIVATE SECTOR

Issue

The Reagan Administration has supported the transition of Landsat from an experimental research and development (R&D) program under NASA to an operational program in the private sector. At the same time, suggestions have been made to transfer the operation of meteorological satellites to the private sector as well. Unresolved issues include if, when, and how to transfer these satellite systems to the private sector, and how to ensure the technological competitiveness of U.S. remote sensing satellites.

Background

NASA developed Landsat as an experimental R&D program and has launched four of these earth resources satellites since 1972. President Carter issued a directive in November 1979 which assigned the management of the operational Landsat system to the National Oceanic and Atmospheric Administration (NOAA), in the Department of Commerce, with the eventual transfer to the private sector. President Reagan also supports the commercialization of Landsat and therefore the Government has no plans to construct additional satellites after Landsat D prime (the fifth in the series) which is scheduled for launch in 1985.

Several private companies have expressed an interest in operating part or all of the Landsat system. Congressional hearings have been held over the past decade on the viability and timeliness of a commercial Landsat system. In addition, the Reagan Administration's Cabinet Council on Commerce and Trade has met three times to determine the possible methods for a Landsat transfer and the desireability of including weather satellite in the transfer.

Analysis

The usefulness of Landsat data has been limited by the lack of long-range plans for an operational system. Some potential users have been reluctant to invest in computers and software until they are assured of a continuous flow of data, while the Government contends that the technology is mature enough to be taken over by the private sector. Without a clearly defined users market, however, some observers have suggested that private operation of Landsat will initially require some form of government subsidy.

Another area of concern is future international competition in earth resources satellite systems. The United States needs to maintain its technological lead in remote sensing or risk losing its users to foreign competition. Also, the failure of a privately operated Landsat system or of the Government to provide such services could lead to U.S. dependence on foreign data sources. A phased transfer, with combined Federal and private operation has been suggested to ensure the survival of the U.S. remote sensing capability. In this senario, the private sector could initially take over data distribution and interpretation, with the future possibility of managing the satellites themselves. High risk research and development on new remote sensing technology would probably remain in NASA or NOAA.

The Communications Satellite Corporation (COMSAT) has expressed an interest in taking over all government satellite remote sensing, including meteorological satellites. The implications of such a transfer are still being assessed.

INTERNATIONAL COOPERATION IN SPACE

Issue

International cooperation has been a major facet of the U.S. space program since the creation of NASA, involving over 100 nations, including the Soviet Union. As space projects become more expensive, international cooperation may provide a mechanism for funding projects which otherwise could not be undertaken. At the same time, the unilateral cancellation by the United States of its part of an international program with the European Space Agency has sown seeds of anxiety in the international community over the reliability of the United States as an international partner.

Background

The National Aeronautics and Space Act of 1958 specifically directs NASA to promote international space activities, and this has been reinforced by the space policy directives of the Carter and Reagan Administrations. Over the course of NASA's history, more than 1,000 agreements have been signed with over 100 countries for projects including the launch of satellites developed by other countries, cooperative development of satellites, use of U.S. communication satellites for experimental programs in countries such as India, training in and use of data from U.S. remote sensing satellites, and development of the Spacelab module which is part of the space tranportation system.

In 1981, the United States unilaterally decided to withdraw from its part of the International Solar Polar Mission (ISPM), a cooperative program with the European Space Agency (ESA) to send two spacecraft to circle the poles of the Sun. ESA and NASA would each have provided one spacecraft. While the United States will still launch and track the ESA spacecraft, it decided that budget constraints would prevent its building the second spacecraft. The fact that the United States voided this agreement, without prior consultation with ESA, prompted considerable concern in the international community over the reliability of NASA as a partner in these programs.

As the costs of space programs grow and budgets throughout the world become more constrained, international cooperation may provide a means for accomplishing space programs which otherwise would be out of the economic reach of an individual country. If the United States wants to expand international cooperation in space, it should be attuned to problems which might develop or have already developed in relations with other countries.

Analysis

Areas of special interest to the 98th Congress in the area of international cooperation in space might include: space science projects, contributions to which are often negotiated with other countries prior to the time NASA requests funding for the program and then, if funding is denied, frustration and ill will may result; potential international cooperation in constructing a space station; assessing whether NASA is doing all it can to foster international cooperation and identifying programs which could benefit from such cooperation; and U.S. activities at the United Nations regarding space activities.

FOREIGN COMPETITION IN SPACE TECHNOLOGY AND SERVICES

Issue

For the first two decades of the space program, the United States held a virtual monopoly in providing space technology and launch opportunities to the free world. At the present time, however, additional countries are developing their own spacecraft and/or launch vehicles, which not only reduces their reliance on the U.S. for these services, but also places them in direct economic competition with the United States. The United States may have to become more business-oriented in space activities in order to successfully compete in these markets, and to maintain a leadership position in space technology.

Background

Until the 1970's, the United States was the leader in the free world in space technology, and the only supplier of space services such as spacecraft launches to other countries. The Soviet Union, although capable of launching other countries' spacecraft, offered to do so only to a few countries and on a cooperative rather than commercial basis.

Recently, however, the United States has been encountering competition both in services and technology. In the service area, four other countries/organizations now have achieved the capability to launch satellites: China, the European Space Agency (ESA), India, and Japan. At the present time, only ESA is competing for commercial launches with the United States, but the other countries may do so in the future. In addition, the Soviet Union recently completed its first commercial launch sale (to India) which may indicate a shift in its policy. Another service area, providing data from remote sensing satellites, is also being threatened by other countries. France will launch its SPOT satellite in 1984, and Japan and ESA are both planning their own remote sensing satellites for either land or sea. Meanwhile, the United States is planning to phase out Government support for its Landsat program, leaving the future of that effort in jeopardy.

There is concern that the United States may have already irreparably lost its lead in communications satellite technology (to France and Japan). For example, high power traveling wave tubes which are needed for direct-to-home television broadcasing satellite are now made only by two companies, one in France and one in Germany. There is also concern about remote sensing satellite technology (in addition to the above mentioned problem of data continuity). The French satellite will use advanced multi-linear array technology and provide stereo images, both of which are beyond the capability of U.S. Landsat satellites.

Analysis

If the United States is to maintain a competitive edge in space technology, it may have to adopt a more business-oriented approach to developing and selling space technology and services. This includes developing a consistent policy on whether the Government or private sector should fund high-risk technology work; developing innovative financing mechanisms for payment for launch services; and making more of an effort to market U.S. space technology/services rather than assuming that countries will come to us.

SPACE STATION: THE NEXT MAJOR SPACE INITI TIVE?

Issue

As the space shuttle enters operational status, NASA has begun to assess what the next space initiative should be. According to NASA leaders, a consensus has developed within the agency that a space station is the next logical step, but outside of NASA, concern has been expressed that a space station program will consume too much of NASA's scarce financial resources. At the same time, DOD is assessing its potential needs vis a vis a manned space station.

Background

Proposals have been made throughout the history of the space program for constructing orbital space stations. The only space station that the United States has placed in orbit, however, was Skylab, which hosted three crews from 1973-1974. The longest duration was the 84-day Skylab 4 mission. The Soviet Union, conversely, has successfully placed five space stations in orbit since 1971, and has hosted crews for more than 185 days.

In 1969, a special task group set forth proposals for the U.S. space program following the Apollo program. Among the proposals were a manned space station and a reusable space transportation system. NASA chose to develop the space transportation system first (the space shuttle), and now is looking to development of a space station to which the shuttle could ferry crews and cargo. The exact nature of the space station is under consideration, and NASA has contracted with eight companies to obtain their ideas of how the space station should be configured. NASA is also requesting input from universities and smaller research groups, as well as from the international community (including the European Space Agency and Japan). The space station could be primarily for operations (such as fueling and storing upper stages), for scientific research, materials processing, or some combination of these. Portions of the station could be manned while others would be unmanned, and it might be a conglomeration of individual modules (some attached and some free-flying) rather than a single unit.

The Department of Defense is also assessing its needs for a permanent space station. During the 1960's, DOD was designing a Manned Orbiting Laboratory (MOL), but the program was cancelled in 1969 because DOD could not justify the need for a manned military presence in space at that time.

Analysis

Although NASA leaders have stated that a consensus exists within the agency to proceed with a space station as the next major step in the NASA program, concern has been expressed by other segments of the space commuity, primarily space scientists, that this would be another expensive effort that will smother other space research just as the Apollo and space shuttle program did. Questions have also arisen as to why the United States needs a space station at all. Supporters of the space station program argue that space science activities can be incorporated into the space station program and that the two activities need not be competitive. Another issue is whether DOD and NASA should jointly develop a space station, or whether the functions and security needs of a military station dictate separate efforts.

RELATIONSHIP BETWEEN MILITARY AND CIVIL SPACE PROGRAMS

Issue

With the advent of the space shuttle, which is being used for both military and civil launches, the line between these two communities is blurring. At the same time, there appears to be an increasing number of active-duty military personnel working at NASA, and a greater proportion of NASA funds being expended in support of DOD missions. Questions have developed over whether the military and civil programs should be separated further, or if the two should be merged.

Background

The 1958 National Aeronautics and Space Act divides responsibility for U.S. space activities into civil and military components with NASA in charge of the former and DOD having responsibility for the latter.

Many of the programs pursued by NASA and DOD are similar. Both have communications, weather, and scientific satellites, and the civil remote sensing satellites (like Landsat) are similar to reconnaissance satellites. This raises the issue of whether the programs are duplicative, and the associated questions of whether the two programs should be merged together or if coordinating mechanisms are adequate to prevent overlap. The Carter and Reagan space policy directives support separate military and civil space programs, while emphasizing the need for coordination.

Analysis

The space shuttle is blurring the lines between the military and civil programs even more because it is used for both types of launches. This has become of special concern in connection with funding for the program. NASA has expended over $10 billion for research and development of the shuttle, while DOD has spent less than $2 billion, even though DOD will be the single largest user of the system during the next 12 years. DOD is funding only the construction of a shuttle launch site at Vandenberg Air Force Base, California, and an inertial upper stage for taking satellites into high orbits. In return, NASA charges DOD a lower price for launching DOD payloads than other Government agencies or commercial users.

A 1982 GAO study concluded that 20.5 percent of NASA's funding directly supports DOD, while another 7.7 percent supports joint civil/DOD missions. NASA disagrees, stating that only 0.1 percent of its funding supports DOD, while 66.3 percent is joint civil/DOD. Most of the discrepancy between the two calculations is connected with allocation of funding for the shuttle and related systems.

Another issue in terms of the military/civil relationship is what appears to be a growing number of active-duty military personnel working at NASA. For example, the head of NASA's space shuttle program is Lt. Gen. James Abrahamson. NASA has traditionally hired a sizable number of military personnel (usually retired, however), and no studies have been done on exactly how many military personnel are now employed by NASA compared to the past, but the appearance is that the military has a greated representation now (in addition, the Deputy Administrator of NASA was Secretary of the Air Force under the Carter Administration.

XIII. TECHNOLOGICAL INNOVATION, INDUSTRIAL R&D, AND TECHNOLOGY TRANSFER

INDUSTRIAL R&D/INNOVATION AND ECONOMIC GROWTH AND PRODUCTIVITY

Issue

Concern continues to grow that the economic performance of the United States is decreasing compared to past levels and relative to the situation in other industrialized nations. One of the causes that has been cited for this is a relative decline in the level and quality of U.S. industrial R&D and innovation.

Background

Although absolute productivity levels in the United States exceed those of France, Japan, West Germany, Canada, and the United Kingdom, U.S. productivity gains between 1960-1978 were the smallest of these industrialized nations. In 1979 the United States showed almost no increase in productivity. In comparison, Japanese productivity gains were more than five times greater than those in the United States.

Technological development is an important factor in economic growth and productivity. Studies have found a strong correlation between R&D expenditures and economic growth. Thus, one of the causes often cited for the decline in growth and productivity is a perceived decline in the level and quality of U.S. industrial R&D and innovation. Industrial R&D performance has essentially stagnated (in constant dollars) for a decade due, in part, to the decrease in federally-funded industrial research and development.

Analysis

To address this issue, two basic types of Federal policies have been suggested: (1) general policies to stimulate the economy as a whole and (2) policies to fund or stimulate R&D and innovation directly. Several activities of the past two Congresses have concentrated on the later. P.L. 96-480, the Stevenson-Wydler Technology Innovation Act mandated a multifaceted approach to innovation. It provided for an Office of Productivity, Technology, and Innovation within the Department of Commerce, for the promotion of innovation and technology development through the establishment of cooperative generic technology centers, and for improved utilization of federally funded R&D by both State and local governments and the private sector.

In an attempt to encourage innovation in the small business sector, P.L. 97-219, the Small Business Innovation Development Act, provides that a set percentage of the Federal R&D budget be allocated to small companies. This is based upon the assumption that, since small firms are so innovative and since the United States needs more innovation, the small business sector should receive a greater share of the Federal research and development money.

To foster industrial spending on innovation activities, P.L. 97-34, the Economic Recovery Tax Act, provides for a tax credit of 25 percent of the qualified research expenditures of a corporation for the taxable year over the base period research expenses. The law allows 25 percent tax credit for 65 percent of all payments to universities to perform basic research. Companies also are permitted a larger deduction for charitable contributions of equipment used in scientific research.

Given what is known about the correlation between technological development, innovation, and economic growth, the issues that still remain concern the determination of the extent of Federal involvement in innovation and what activities would have the most positive results. An analysis of the impact of current policies can provide guidance to future congressional action.

INDUSTRIAL SUPPORT OF BASIC RESEARCH

Issue

What steps should Government and/or industry take to broaden the choice and capability of industry to conduct more long-range basic research, which some deem essential to enabling this Nation to maintain a high technology trade posture?

Background

There is some evidence that the amount of R and D funded by U.S. firms is increasing. The NSF estimates that in 1983, industrial R and D support is expected to amount to $42.6 billion, 11 percent more than the amount estimated for 1982. In terms of real 1972 dollars, this amounts to about a 4 percent increase between 1982 and 1983. However, generally U.S. industrial research and development has been characterized as being too focused on short-term research, which leads to immediate profits, and less on long-range research and develpment, which together with improved management marketing strategies might enhance domestic economic productivity and give this Nation a competitive edge vis-a-vis such other countries as Japan, West Germany, and France. Industrial firms in these countries are not only obtaining more patents in the United States, but also are significantly increasing productivity; their share of high-technology trade in foreign markets, until recently, has been controlled by U.S. firms.

According to the National Science Foundation, industrial support for basic research in 1982, using industry-generated funds, is expected to total about $1.3 billion, 3 percent of the total amount of funds that industry spent on research and development. Total industrial support of basic research, including funds supplied by the Federal Government, is expected to amount to $1.6 billion in 1982, or 17 percent of the national total for basic research. Between 1965 and 1974 industrial spending for basic research fell at an average annual rate of 2 percent. Between 1975 and 1980, industrial support for basic research increased at an average annual constant-dollar rate of 5 percent, mostly for energy research. In 1981 and 1982 real-dollar industrial support of basic research is estimated to increase 4 percent each year, with most of the increase directed toward energy programs.

Analysis

Major issues for consideration are: (1) Should the Government increase funding for basic research in industry, perhaps by increasing the National Science Foundation's allowable support programs to include more awards for basic research in industry; by requiring that a minimum percentage of I, R and D contract funds be used for basic research; or by including a percentage for basic research as part of overhead? (2) Should the Government enlarge private sector incentives to do basic research by amending the Economic Recovery Tax Act (P.L. 97-34) to give more benefits to industry for research and to include social sciences research; by allowing exemptions to the antitrust acts to promote joint research among industrial firms; and by changing U.S. Government patent policy to promote the commercial exploitation of Government-generated inventions? (3) Would U.S. high-technology trade be enhanced if measures were adopted to require reciprocity in information flows and market shares with foreign coutries? Legislation was introduced on this subject in the 97th Congress.

ROLE OF THE FEDERAL GOVERNMENT IN THE COMMERCIALIZATION OF FEDERALLY-FUNDED RESEARCH AND DEVELOPMENT

Issue

The Federal Government spends approximately $40.6 billion (FY82 est) for research and development. At issue is what mechanisms have been, and can be, developed to encourage the commercialization of federally-funded R&D so that these technologies are brought to the marketplace where they can contribute to the economic and technological growth of the United States.

Background

In pursuit of their missions, Federal departments and agencies fund and perform research and development which has resulted in a wealth of new products and processes. However, most Federal units lack the authority and/or ability to further develop, adapt, and commercialize the results of the R&D endeavor. Thus, many of these technologies do not reach the marketplace.

Several recent laws have attempted to encourage commercialization of federally-financed research and development. P.L. 96-517 allows small businesses, not-for-profit organizations, and universities to keep title to inventions made under Federal funding. Section 11 of P.L. 96-480, the Stevenson-Wydler Technology Innovation Act, creates, among other things, various mechanisms to encourage the transfer of technology to the private sector in the hope that industry will develop and commercialize such technologies.

Analysis

Given the large amounts of money and time expanded on the Federal R&D enterprise, it seems desirable to expand the return on the Nation's investment. Commercialization of technology by industry and small businesses brings new products and processes into the marketplace to meet both public and private demands. This creates employment opportunities and contributes to the Nation's economic viability. It also provides solutions to the increasing number of technologically-oriented problems. The present concern for the decreasing technological lead of the United States should encourage further consideration of promotion commercialization of technologies developed in Federal laboratories.

Federal patent policy has been criticized as one barrier to the commercialization of federally-funded R&D. Because Government patents have been available to anyone through licensing procedures, business is hesitant to invest time and money because the uniqueness of the technology cannot be assured. P.L. 96-517 addressed this issue and permits small businesses, universities, and not-for-profits to retain title to inventions made with Federal financing. Efforts were underway in the 97th Congress to extend this right to all firms, regardless of size, in the hopes that it would increase commercialization of these technologies.

The Stevenson-Wydler Technology Innovation Act mandates that ". . . the Federal Government shall strive where appropriate to transfer federally owned or originated technology . . . to the private sector." To accomplish this, each Federal laboratory is required to establish an Office of Research and

Technology Applications. A Center for the Utilization of Federal Technology also is mandated; this organization has been created under the National Technical Information Service of the Department of Commerce. The extent to which the agencies are complying with the requirements and intent of P.L. 96-480 remains to be determined. Still open to discussion is to what extent the Federal Government should, and can, encourage commcerialization and what have been the results of these previous efforts.

GOVERNMENT PATENT POLICY: OWNERSHIP OF FEDERALLY FUNDED INVENTIONS

Issue

Should the provisions of P.L. 96-517 regarding the vesting of title to federally funded inventions in universities and small businesses be extended to for-profit corporations?

Background

Until the 96th Congress, there was no uniform Federal patent policy for the ownership and licensing of inventions resulting from federally funded R&D. In the 96th Congress, P.L. 96-517 was passed to provide that non-profit organizations, including universities, and small business firms have the option to elect to retain title to such inventions, with a few well defined exceptions. The law also provides that Federal contractors, including for-profit corporations, may be granted exclusive or partially exclusive licenses in any inventions covered by a federally owned patent or patent application under certain conditions. Bills were introduced in both the House and Senate in the 97th Congress to extend to for-profit corporations the option to elect to retain title to such inventions. Bills were referred to two House committees and one Senate committee and were reported by one House committee and the Senate committee. As of the 1982 pre-election adjournment, no further action had been taken on either Senate or House bill.

Analysis

At issue are whether the patent clause of the U.S. Constitution would be most effectively promoted by extending the patent ownership of P.L. 96-517 to for-profit corporations; whether the Federal Government would be adequately recompensed for its funding of inventions by contractors which successfully commercialize inventions; and whether the overall patent provisions as proposed are particularly required today in light of national economic stagflation, apparently decreasing technological innovation in the United States, and increasing international competitiveness, even in high technology trade.

The four years of debate on the issue during the 96th and 97th Congresses has brought the issue to broad congressional, university, and big and small business attention. The issue is likely to receive continued attention in the 98th Congress and bills are likely to be introduced similar to those reported in the 97th Congress.

INDUSTRY-UNIVERSITY-GOVERNMENT COOPERATION IN INDUSTRIAL INNOVATION

Issue

The increasing concern over the state of economic growth in the United States has encouraged the identification of mechanisms to stimulate industrial innovation. Industry-university-Government cooperation in technological development is a contributing factor in increasing innovation. Because universities traditionally perform basic research, but do not have the commercialization capacity that industry possesses, efforts to foster increased interaction between these two sectors have been made to augment the potential for the development of new products and processes. At issue is what is the proper role of the Federal Government in building the linkages between universities and industry.

Background

Universities educate the scientists, engineers, and managers employed in industry. Universities also perform much of the basic research that industry develops into commercially viable products and processes. In recent years the relationship between universities and industry may have weakened. There are various reasons attributed to this. It has been asserted that the universities are no longer attuned to the needs of industry and, as a result, companies have established their own graduate-type programs. Increased Federal support of universities has replaced industry financing and altered the priorities of university research. The focus on training students to solve industrial problems, which resulted from industrial support of faculty research, has been lost to a significant extent.

Several recent laws have made an attempt to encourage industry-university-Government cooperation. P.L. 96-480, the Stevenson-Wydler Technology Innovation Act, authorized the establishment of cooperative generic technology centers which, while not limited to universities, would have established a means for industry and academia to work together. However, the Department of Commerce, under the Reagan Administration, has chosen not to fund these centers. An alternative approach, supported by the current Administration, is that contained in P.L. 97-34, the Economic Recovery Tax Act. Title II provides, in part, a 25 percent tax credit for 65 percent of all company payments to universities for the performance of basic research. Companies also are permitted a larger deduction for charitable contributions of equipment used in scientific research.

Analysis

While there is little disagreement over the fact that innovation and productivity are vital components in economic growth and are, therefore, of legitimate concern to the Federal Government, it has not been determined to what extent the Government should be involved in the university-industry cooperation aspect of the innovation issue.

There have been several precedents for Federal involvement in encouraging industry-university interaction, as discussed above. In addition, a program

at the National Science Foundation has demonstrated that the Federal Government can serve as a catalyst for such cooperation and can develop programs which do not require continual Federal funding but, instead, are subsequently supported by industry.

Of assistance in the determination of the Federal role in this issue would be an analysis of the results of the tax credit and its impact on encouraging innovation. Slated to be effective for two years, there have been efforts to make this measure permanent. However, other questions still remain as to whether Federal policies aimed at improving the economy as a whole or policies to fund or stimulate innovation directly are the most effective.

FEDERAL-STATE-LOCAL COOPERATION IN INDUSTRIAL INNOVATION

Issue

The Reagan Administration is fostering increased governmental responsibilities in State and local jurisdictions. These governmental units are beginning to recognize the benefits to be derived from a strong, innovative, high technology community. At issue is what can the Federal Government do to assist State and local governments in creating an environment receptive to innovation.

Background

The economic success of Silicon Valley in California, Route 128 in Massachusetts, and Research Triangle Park in North Carolina have sparked State and local interest in high technology development. High technology industries provide increased employment and taxes. A study by the Joint Economic Committee found that these types of firms accounted for 75 percent of the net increase in manufacturing jobs from 1955 to 1979. Thus, States and localities appear eager to foster development and location of such companies within their jurisdiction.

Analysis

Interest in State and local initiatives to encourage the development and location of high technology industry has only recently begun to evolve. Research into this area is limited. To this point, attention to this issue generally has been restricted to State and local governments; however, given the national interest in innovation and the increasing responsibility that the Federal Government is placing on State and local jurisdictions, there may be a legitimate Federal concern in this area. What needs to be determined is what, precisely, is the Federal role in assisting State and local governments in creating an environment conducive to the development of high technology industry and what, if any, Federal strategies can be implemented to encourage State and local activities to accomplish this.

IMPLEMENTATION OF THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT

Issue

The Stevenson-Wydler Technology Innovation Act mandates several activities designed to encourage industrial innovation to promote economic growth. At issue is how the provisions of the legislation are being implemented in the executive branch and the extent of their impact on the national economy.

Background

Concern over what is perceived as a declining innovative capacity and decreasing productivity and economic growth led to the passage of the Stevenson-Wydler Technology Innovation Act (P.L. 96-480). Incorporating several initiatives outlined by President Carter in his Industrial Innovation Message (October 31, 1979) and mandating several new activities, the legislation is designed to promote technological innovation for the achievement of U.S. economic, environmental, and social goals. This is to be achieved by (1) the creation of organizations within the executive branch to study and stimulate technological innovation, including the Office of Productivity, Technology, and Innovation in the Department of Commerce; (2) the promotion of innovation and development through the establishment of cooperative centers for industrial technology; (3) the improved utilization of federally-funded R&D by both State and local governments and the private sector; and (4) the institution of an exchange program of scientific and technical personnel between universities, industries, and the Federal laboratories.

Analysis

The Reagan Administration's approach to the implementation of Stevenson-Wydler appears mixed. While it is likely that while there will be funding for an Office of Productivity, Technology, and Innovation within the Department of Commerce, there will not be a cooperative, generic technology program due to the current Administration's opposition to the provision of grants. Instead, the office plans to provide information to industry and to serve as a broker between the various sectors involved (which include industry, universities, and Government).

However, the extent to which all provisions of the law are being implemented remains unclear at this point. The Stevenson-Wydler Technology Innovation Act was the major legislative result in the 96th Congress of the on-going congressional effort in innovation. As such, Congress should be able to ascertain whether or not the intent of the law is being carried out in the executive branch. Concern over the innovation issue is expanding rapidly and future congressional activity may be based upon the success or failure of the measures contained in P.L. 96-480.

SMALL BUSINESS AND INNOVATION

Issue

Small businesses have contributed substantially to the economic growth of the United States. In an attempt to encourage innovation in the small business sector, Congress enacted P.L. 97-219, the Small Business Innovation Development Act, a law designed to increase the amount of Federal research and development funds allocated to small firms. At issue is whether the set-aside concept is the most auspicious means to encourage innovation and what effect this approach will have on the total Federal R&D endeavor.

Background

P.L. 97-219 attempts to increase small business participation in Federal R&D through the creation of a Small Business Innovation Research (SBIR) program in each relevant Federal agency. This initiative is modeled after an SBIR activity at the National Science Foundation and is funded by a mandatory set-aside. The set-aside is a fixed percentage of that agency's research and development budget. The rationale behind this effort is that, since small companies are so innovative and because the United States needs more innovation, this sector should receive a greater share of the Federal R&D budget.

Analysis

The set-aside concept is one which has many critics. It is argued that a set-aside distorts the traditional relationship between the public and private sectors and interferes with the normal efficiency of the marketplace. It also has been asserted that the set-aside mechanism circumvents the congressional budget process which is used to determine program priorities and budget allocations.

Additional concerns have been raised as to the extent of the R&D capacity within the small business sector. It is unclear whether small firms can provide the amont of technical and scientific knowledge (1) required by the increased percentage of research and development funding and (2) which meet the needs of the Federal agencies. Questions also remain as to what impact the set-aside provision will have on other Federal R&D efforts, including the funding of basic research in universities.

Federal funding for research and development is of major importance to the Nation's technological development and economic growth. Measures which alter the funding process may have significant impact on the innovative capacity of the United States. Thus, the Congress may want to assess the impact of P.L. 97-219 on the Federal R&D establishment, on industrial innovation, on university research, and on the general economic position of the United States.

ORGANIZATIONAL RESPONSIBILITY FOR TECHNOLOGY: A NATIONAL TECHNOLOGY FOUNDATION

Issue

Concern has been expressed over the Government's support of the application of technology to national needs. The National Technology Foundation (NTF) has been proposed as one mechanism through which the Federal Government can focus on and support applied research and development.

Background

The problems the United States is experiencing in terms of declining economic growth and decreased innovation have drawn attention to the role of applied R&D in providing new products and processes to meet national needs. The responsibility for applied research is diffused throughout various institutions in the Federal Government. The congressional initiative of the 96th Congress to create a National Technology Foundation was designed to bring these activities together. The functions of the Foundation would include the study of innovation and the development and implementation of policy. In addition, the proposed organization of NTF would include the aggregation of several programs under the aegis of one agency, to include the National Bureau of Stadards, the Patent and Trademark Office, and the National Technical Information Service of the Department of Commerce, and the Office of Small Business Research and Development, the directorate for Engineering, and several working groups of the National Science Foundation.

Analysis

The importance of the innovation issue and the contribution of technological development to economic growth makes the issue of organization very timely. The United States is the only competitive industrial nation which does not have an industrial planning organization or one that fosters cooperative relations between industry and Government. This lack of focus, critics argue, is one major barrier to increased economic growth. Conflicting policies between and among Federal agencies cause industry uncertainty. While few advocate centralized planning, there is a generally recognized need for some guidance from the Fedeal Government. Still to be determined is the extent to which the Government should be involved in the area of innovation and in efforts to guide the private sector.

Once this is decided, the Congress may want to address the issue of how Federal responsibility for technology is organized. Are existing structures adequate to support applied technology and development, or is a new Federal unit necessary? If the latter is determined to be the case, decisions must be made as to its organization and operation.

TECHNOLOGY TRANSFER: USE OF THE RESULTS OF FEDERALLY FUNDED R&D BY STATE AND LOCAL GOVERNMENTS

Issue

There have been increasing demands placed on State and local governments for the provision of goods and services. The Federal Government, with its extensive technical and scientific resources, has become a principle focus for technological assistance not available in the private sector. At issue is the extent to which Congress should facilitate and encourage State and local governments to use the results of federally funded research and development.

Background

Congressional concern over the intergovernmental transfer of technology resulted in the inclusion of section 11 in the Stevenson-Wydler Technology Innovation Act. This portion of the law mandates that since "it is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation's Federal investment in research and development," the Government shall act ". . . to transfer federally owned or originated technology to State and local Governments . . ."

To accomplish this, the legislation mandates the establishment of Research and Technology Applications Offices in each Federal laboratory, and that those laboratories having a total annual budget exceeding $2 million are required to provide at least one professional full-term staff person. In addition, each Federal agency which has one or more Federal laboratories is directed to allocate not less than 0.5 percent of the agency's R&D budget to support the technology transfer function. The bill also indicates that information transfer itself is not sufficient and that the Offices of Research and Technology Applications are to provide technical assistance in response to requests from State and local officials. In addition, the bill creates the Center for the Utilization of Federal Technology at the Department of Commerce to serve as a focal point for information dissemination, coordination of the Offices of Research and Technology Applications, and reception of requests for assistance by States and localities.

Analysis

The Reagan Administration policies include giving State and local jurisdictions increased responsibilities in the provision of goods and services. A way to meet these increased demands is to adapt and apply technical knowledge already available in the Federal R&D establishment. P.L. 96-480 provides a mandate and a means to accomplish this. Section 11 of the Stevenson-Wydler Technology Innovation Act was the major legislative result of the on-going congressional effort in intergovernmental science and technology. As such, it should be of importance that the intent of the law be implemented in the executive branch. It may be of immediate interest to the Congress to confirm that the mandate of this law has been carried out and to assess what has been its impact throughout all three levels of Government. Future Federal activity may be based upon the success or failure of the measures contained in P.L. 96-480.

XIV. TRANSPORTATION R&D

PRIORITIES IN TRANSPORTATION R&D

Issue

The research and development program of the Department of Transportation is intended to provide the information and the new technology needed for operational programs, such as air traffic control, and for regulatory programs, such as automotive safety standards. With the change in Administration, R&D funding for these purposes was cut back in several areas, under the theory that some of DOT's research and development projects could better be performed by the private sector, or by State or local governments. However, with the economic recession being particularly severe in the transportation area, it is questionable whether lines of research and development being dropped by DOT can be adequately pursued by private industry or by other levels of government.

Background

Transportation affects the life of all people, either as passengers, as consumers of goods transported from their point of manufacture, or as employees of the transportation industry. The Federal Government alone spent about $24 billion on transportation-related programs in 1981. Transportation research and development is divided among the many diverse programs that make up the Department of Transportation and related agencies. Among the many transportation-related issues for which research and development are important are: motor vehicle safety, motor vehicle efficiency, the national highway system, urban mass transportation, water transportation, the national railway system (both passenger and freight), and the national aviation system.

With the change from the Carter to the Reagan Administration, transportation research and development underwent a shakeup. The total spending for this purpose dropped from $407.3 million in FY1981 to $311.7 million for FY1982. The budget request for FY1983 recovered to $388.5 million, but some areas of transportation R&D funding remained substantially lower than they had been two years before.

Two areas of reduced R&D activity are particularly noteworthy. The funding level for the Federal Railroad Administration dropped from $41 million in FY81 to $23 million in FY82, and further to a budget request of $20 million for FY83. This reduction "would eliminate nearly all nonsafety research", according to the Administration. Projects aimed at enhancing productivity in the rail industry have been phased out on the grounds that they should be funded by the railroad industry which is the primary beneficiary of such research. The funding level for R&D for the Urban Mass Transportation Administration was cut from $65 million in FY81 to $50 million in FY82, and to $43 million in the FY83 request. Emphasis now, according to the Administration, is to be "on assisting proven transit systems". Thus research on development of advanced mass transit systems is to be left to others, presumably the local governments in the urban areas, who may not be able to carry out such advanced programs.

Analysis

Some argue that continued support of transportation research and development at the Federal level is important if the Nation is to continue to advance the "state of the art" in such areas as railroad productivity and advanced mass transit systems. Whether the work would be done elsewhere, under present economic conditions, is questionable.

There may also be a need for better coordination of R&D within DOT. The Department of Transportation is made up of nine major subagencies, each with its own R&D function. DOT presently estimates its total amount of R&D funding only once a year, as part of its annual submission to OMB. It might be useful for the Department to better coordinate and prioritize its own R&D activities.

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TRANSPORTATION SAFETY R&D

Issue

Automobile accidents cause close to 50,000 deaths per year, and take a heavy toll in injuries and in damage to property. Accidents in other modes of transportation (rail, air, etc.) have lesser impacts on society but are still causes for concern. Technologies exist that can help diminish the frequency of transportation accidents and their costs to society.

Background

According to the National Safety Council, transportation-related accidents accounted for 56,564 deaths in 1978, the last year for which complete statistics exist. Of these, 52,411 were caused by motor vehicle accidents, 602 by railway accidents, 204 by "other road vehicles", 1467 by water transport, and 1880 by air transport. Technologies exist that could alleviate this problem. For example, for automobiles, the "air bag" is a technological solution that might prevent a large number of fatalities and serious injuries. The problem of "drunk driving", which is involved with roughly half of the automotive fatalities, might be alleviated by devices intended to prevent motorists from being able to use their cars while inebriated.

Analysis

The Reagan Administration is committed to a policy of decreased regulation of the auto industry, on the grounds that regulation in the past has been excessive and has been a burden on the industry. Thus, steps have been taken to eliminate the air bag requirement, lower the standard for bumpers, etc. However, a government policy of deregulation does not prevent the auto industry from taking steps on its own to increase auto safety. Auto safety might "sell", as it has not in the past, because of increased public concern with the issue. Technologies that would improve automotive safety at minimal cost therefore could be of great interest, both to the auto industry and to the Government.

With regard to the other transportation-related accidents, e.g. rail, ship, air, etc., there would similarly be an interest in technological means of decreasing their frequency and impact on society.

FUEL ECONOMY R&D

Issue

Automobile fuel economy standards as stipulated in the Energy Policy and Conservation Act of 1975 (P.L. 94-163) have been met or exceeded by conventional internal combustion engines. Parallel to this success with conventional designs, several research programs are actively seeking additional economy and/or lower emissions by exploring unconventional engines or propulsion systems. These include external combustion systems such as the Stirling engine, electric cars using chemical batteries, new chemical batteries for electric cars, and fuel cell power plants. It may be appropriate at this time to assess the progress made and the prospects for a practical contribution among these unconventional engines and propulsion systems.

Background

The twin goals of greater fuel economy and reduced exhaust emissions have spurred research on external combustion engines as well as on electric propulsion systems. An external source of heat such as a burner can be adjusted for a cleaner burn than an internal combustion engine. External combustion engines also hold forth the prospect of greater flexibility in fuel composition since an open burner has none of the special octane and vapor pressure requirements of the internal combustion engine.

Electric vehicles using chemical batteries are free of emissions at the point of use. The energy required to charge the batteries is generated in a power plant where the combustion products are remote from the densely populated streets.

The fuel cell, already proven for large scale generation of electricity, offers the possibility of electric propulsion through the flameless combustion of conventional or unconventional hydrocarbon fuels. The fuel cell, now extremely expensive, has an efficiency two to three times as great as internal combustion engines.

Analysis

Since fuel economy is a specific goal, it may now be possible to assess the progress and probable ultimate contribution of the various programs in this category. Such an assessment could lead to an appropriate emphasis on the most promising technologies and possibly the deletion of those least likely to make a significant contribution.

HIGHWAY R&D

Issue

Highways are a major portion of the national transportation system. Research and development with regard to highways is important in that it contributes to highway travel safety and to prolonging the useful life span of older highways and bridges.

Background

Nearly 90 percent of the intercity passenger miles traveled occurs on highways. More than one-fourth of the total quantity of intercity freight is shipped on the Nation's highways. The cost of the national highway network over the past 60 years has been estimated at over $600 billion, and the estimated cost of replacing this network would be from $1 to $3 trillion.

Research and development on highways, in recent years, has produced advances such as: use of a chemical, calcium magnesium acetate, as an alternative to salt during winter freezing; new structural applications for high-strength concrete; protective systems to alleviate the effect on highways of wind, flood, and earthquakes; and structual retrofitting to extend the service lives of older bridges.

Analysis

Highway R&D spending is on the order of $13 million per year. This is not a large amount, compared to other Federal programs; however, this program may be critical in maintaining the usability of the Nation's expensive and aging highway network. Careful oversight of this program would be useful in assuring that this national asset is utilized to its fullest capacity and protected against deterioration.

MARINE SURFACE TRANSPORTATION R&D

Issue

The U.S. maritime transportation industry is a valuable national asset. Almost one billion tons of the Nation's imports and exports are transported annually by this industry. Approximately one billion tons of cargo are transported annually by the domestic waterway operations element of this industry of which about 60 percent is transported by the inland waterway sector. In the interests of achieving a competitive, vibrant seafaring industry based in the United States, a continuing national program of marine transportation R&D bears examination.

Background

An estimated 70 to 75 percent of the world's foreign trade and commerce is carried in ships and other watercraft on the ocean, seas, and waterways of the world. The conduct of a vigorous marine transportation R&D effort bears consideration if the United States is to regain a competitive posture on the world's ocean. It is necessary from time to time to re-examine and review the vitality, purpose, adequacy, and direction of the existing U.S. marine transportation R&D effort in order to identify and attempt to remedy possible current and future deficiencies, gaps, and specific problems. It is also useful, on another level, to consider whether the technology and facilities where such research is conducted are adequate and whether new technology is being integrated into present marine transportation research programs.

Analysis

Several areas and fields of marine R&D are currently being pursued federally and privately in the maritime industry. Coping with high cost and declining quality of marine fuels has become a problem, imposing ever-increasing operational costs on ship owners and operators for pretreatment and cleaning of heavier, lower grade bunker fuels, to cite just one example. This in turn implies a need for study of alternative fuels for maritime use and of marine power/propulsion systems and engine options for the 1980s (including commercial sail). In these days of rising fuel costs, making shipboard electrical generation systems more efficient, economizing on electrical demands, and finding new, fuel-efficient ways of producing electricity beyond the conventional diesel generators could prove beneficial in the long run. In order to make better and more efficient use of marine fuels of whatever kind, the search for more economy in maneuvering and thrusting might be accelerated to catalyze research into power conserving propellers and thrusters. Training and crewing for the electronic age in shipping and guaging the impact of electronics on shipping operations are emerging as issues unequaled in importance. Minimizing the time a ship is out of service for inspection, maintenance, repair, and overhaul can be crucial to economic operations. Consequently, it appears appropriate to encourage continued investigation and research into marine coatings and finishes as well as other methods of countering or controlling biofouling and corrosion of marine surfaces and materials. Faster turn-around in shipyards implies the need for continuous review and re-examination of present methods of construction and conversion involving a greater degree of reliance on prefabrication and subassemblies. Other issues bearing investigation are the extent to which new technology is being developed by other maritime nations, the adequacy of such technology, and the degree to which this technology is penetrating the marketplace. It is also useful to consider the balance between federally funded programs and privately supported efforts in view of Administration policy to reduce Federal spending and bureaucracy, rely more heavily on free market forces and private sector investments for near term technological development, and emphasize Federal funding priorities for long term, high risk research and development.

XV. WEATHER, CLIMATE, AND EARTH SCIENCES

POLYMETALLIC SULFIDE DEPOSITS/NEW DIRECTIONS IN MARINE RESEARCH

Issue

Recent discoveries of mineral formation on the seabed such as manganese-cobalt crusts and polymetallic sulfide deposits have significant implications with regard to the furtherance of scientific knowledge of crustal dynamics and ore formation and for potential mineral supply. These discoveries have both stimulated and been fostered by recent advances in deep ocean research technology. In view of these discoveries, some within 200-mile coastal zones of the United States or U.S. territories, legislation to create or implement an Exclusive Economic Zone to provide a stable legal framework for future mining activity may be considered.

Background

For more than 15 years U.S. firms have been developing the technological capability to recover and process manganese nodules from the deep ocean floor. During most of this time the freedom of access to recover these nodules on a commercial scale has been clouded by discussion within the United Nations Seabed Committee and subsequently within the Third U.N. Conference on the Law of the Sea. On April 30, after 8 years of difficult negotiations, the U.N. Conference on the Law of the Sea voted 130 to 4 (with 17 abstentions) to adopt a new Convention covering nearly all aspects of the law of the sea, including the establishment of territorial limits, exclusive economic zones, and a regime to govern access to the seabed beyond the limits of national jurisdiction. The United States voted against adopting the Convention. On July 9, President Reagan announced that the United States would not sign the Convention because of its objections to provisions related to deep seabed mining. Concurrent with the Law of the Sea deliberations, in 1977 polymetallic sulfide deposits were discovered forming around hot spings venting through the ocean floor. These discoveries, the product of may years of research, have become one of the most exciting areas of marine research. Recently they have become popularized, although certainly prematurely at best, into a new seabed metals bonanza.

Analysis

The U.S. decision not to sign the Law of the Sea Convention leaves domestic ocean mining interests with continued uncertainty regarding future access to potential mine sites and the continued development of deep ocean mining technology. The possibility of discovery of even more enriched metal deposits within a 200-mile coastal zone of the United States has enhanced the prospects of increased minerals self-sufficiency and raised the suggestion of establishing an exclusive economic zone for the United States similar to that defined in the Law of the Sea Convention. Legislation to establish such a zone has recently been introduced into the 97th Congress and will likely be reintroduced into the 98th Congress. Congress may wish to examine the advantages and disadvantages of establishing such a zone, the implications for scientific research in addition to ocean mining interests and mining research and technology development, and impacts on other ocean uses including foreign trade and fishery conservation and management. What is the appropriate Federal role in funding research on polymetallic sulfide deposits and what level of funding is needed? To what extent are the primary agencies involved (NSF, USGS, and NOAA) coordinating their activities to avoid duplication of effort?

OVERSIGHT OF THE EARTHQUAKE HAZARDS REDUCTION PROGRAM

Issue

The National Earthquake Hazards Reduction Program was established to help mitigate the effects of disastrous earthquake damage in the United States through identification of high seismic risk areas and research and development in earthquake prediction, modification, and control. On October 1 the House and Senate agreed on a one-year reauthorization of the program to include $1 million for an earthquake prediction system in southern California with the goal of having such a system operational by 1988. The U.S. Geological Survey, in conjunction with other Federal agencies and the State of California, has been charged to submit to Congress by July 1, 1983 a plan indicating the tasks, responsibilities, and milestones required to have such a capability by 1988 and to be able to respond to information from such a capability.

Background

In accordance with the Earthquake Hazards Reduction Act, the National Earthquake Hazards Reduction Program was submitted to Congress on June 22, 1978. This program outlines specific actions and assignments for Federal agencies. Subsequently, the Federal Emergency Management Agency (FEMA) was designated as the lead agency to exercise responsibility under the Act and under the National Earthquake Hazards Reduction Program. With the increased population in earthquake prone areas, the likelihood of a severe damage from earthquakes is increased. Recently the National Security Council's Ad Hoc Committee on Assessment of Consequences and Preparations for a Major California Earthquake concluded that the Nation is essentially unprepared for a catastrophic earthquake in California that can be expected to occur in the coming decades.

Analysis

The Congress may wish to continue to exercise general oversight of the Earthquake Hazards Reduction Program to assess the progress and balance in achieving the objections established in section 5(c) of the Earthquake Hazards Reduction Act. What is the current status of research in earthquake prediction, control or mitigation? It is feasible to expect a predictive capability for a major earthquake in southern California by 1988, and what are the implications of having and releasing such information? What progress has been made in developing earthquake resistant construction and model codes? What actions have been taken to study the appropriate Federal role in the earthquake insurance market vis-a-vis the National Flood Insurance Program?

OCEAN RESEARCH AND DEVELOPMENT

Issue

Periodic review and evaluation of the purposes, adequacy, direction, and vitality of the U.S. capability in ocean research and development is both necessary and appropriate in order to identify and attempt to remedy current and future deficiencies, gaps, and specific problems. In view of a number of deterrents which now and in the near future could place restraints on marine research and development, such as inadequate resources and international restrictions on research, and in consideration of the emergence of new ocean research technologies such as ocean-sensing satellites and new development opportunities such as those offered by recently discovered polymetallic sulfide deposits, this appears to be an opportune time to re-examine the U.S. marine research and development effort.

Background

Achievement of benefits from marine resources and the ability to predict and manage the oceans depends on maintenance of a healthy marine research effort, which includes research sponsored by the Federal Government as well as by States and private organizations. Many ocean research projects over the past four decades have been conducted by universities and research institutions, funded by the National Science Foundation (NSF) and the Office of Naval Research (ONR). Since 1967, the National Sea Grant Program, through Federal grants and matching State funds, has promoted marine training, provided marine advisory services, and supported applied marine research. Ocean engineering and development programs have been conducted by the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, and the Departments of Energy, Interior, and Transportation.

Analysis

In recent years ocean research has been increasingly hampered by growing restrictions imposed by foreign governments on research projects in coastal waters and in their extended economic zones. The law of the sea convention, adopted in April 1982 by 130 countries but opposed by the United States, will bring increased restrictions on marine research when it comes into force, especially for scientists from the United States, which, as announced by the Administration, will not become a party to the treaty.

The high costs for operating research vessels has resulted in a notable decrease in demand for ship time. Some researchers believe that a threat to the ability to go to sea, in larger deep-water vessels, is not in the national interest, since study of global problems would be restricted. Recently, a study of the need and utilization of ocean research vessels was completed by the National Academy of Sciences, and a similar study is now underway by the FOFCC. The Congress could review these studies and conduct oversight hearings on research and survey vessels and other research facilities.

Progress achieved in ocean-sensing satellites, computer power, ocean data buoys, and submersible vehicles may be slowed in the immediate future, owing to current concern about Federal spending. Administration plans include an indefinite deferment of the development of a national ocean satellite system.

In both fiscal years 1982 and 1983, the Administration has proposed elimination of the National Sea Grant program. Congress could re-examine the costs and benefits of this program and determine whether to strengthen it or agree to its termination.

AN IMPROVEMENT ACT FOR THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Issue

The National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce currently operates under a large number of diverse authorities. A large portion of the agency programs are under permanent authorization, while the remainder of its programs are authorized at various times, for one or more years, and often for relatively small appropriations in view of the total agency budget. It has been recommended by some that Congress enact an organic act for NOAA, providing an agency charter as well as a single agency authorization.

Background

NOAA was established within the Department of Commerce under Re-organization Plan No. 4 of 1970, bringing together some, but not all, of the Federal agencies and programs dealing with the atmosphere and oceans. Since its establishment, the existing complex of nearly one hundred authorities under which the agency operated was augmented as new responsibilities were assigned to NOAA under a variety of legislation. By executive branch directive in 1980, NOAA was also assigned lead agency responsibility for all civil remote sensing satellite programs.

Interest arose for an organic act for NOAA both in Congress and the Administration during the 95th Congress, when bills were introduced and hearings were held in both houses on legislation designed to lead to such an act. Most of the legislation previously proposed contained a provision for a single, two-year authorization for NOAA's programs. In recent years the issue of agency authorization has also been considered in proposed legislation apart from an organic act. Opposition to an organic or improvement act for NOAA has developed within other executive branch agencies, where it could be perceived as a possible invasion into their programs through an expansion of NOAA's charter, and, to some extent, within the Congress, where committee jurisdictions may appear to be threatened.

Analysis

It is anticipated that interest will be revived during the 98th Congress in enacting legislation which will provide a single authorization for NOAA, whether for a single year or on a multi-year basis. It is also likely that the concept of an agency organic act will also be reintroduced, based on continuing interest by the Congress and within NOAA, where an internal reorganization has been proposed by the Administrator. NOAA is also in the process of changing its budget structure so that functions in the budget are more closely allied with the organization; hence, legislation enacted to provide single agency authorization could reflect the new organization and budget structure. In considering an improvement act for NOAA, Congress may wish to enact legislation addressing only the authorization process or legislation might include both the provision for authorization of the whole agency as well as a NOAA charter such as in the organic bills introduced previously.

NATIONAL WEATHER MODIFICATION POLICY

Issue

By enacting the National Weather Modification Policy Act in 1976, Congress affirmed its interest in establishing a national policy in weather modification. A comprehensive study, mandated by the Act and commissioned by the Secretary of Commerce, recommended such a weather modification policy and supporting Federal research program; however, no specific legislation has been passed subsequently under which the program would be established. Many argue that ultimate success in the application of weather modification technology requires a clear Federal commitment to technology development and a strong, integrated research program.

Background

Weather modification is the intentional alteration of atmospheric conditions for human purposes--to augment water supplies by enhancing precipitation or to reduce economic losses, injuries, and deaths by mitigating adverse effects of hail, fog, lightning, and severe storms. Cloud seeding is now attempted, with some success, on a commercial basis to clear fog from airports, to augment snowpack in mountain regions, to increase rain from summer storms, and to reduce crop damage from hail. These technologies and other contemplated capabilities--such as suppression of lightning and reduction of the severity of hurricanes--all require much additional research, however, before they are advanced to a state where results are predictable.

Current Federal involvement in weather modification is focussed almost entirely on research, with principal programs supported by the Bureau of Reclamation and the National Oceanic and Atmospheric Administration in the Departments of the Interior and Commerce, respectively, with relevant basic research sponsored by the National Science Foundation. Federal funding for weather modification research peaked at about $20 million in fiscal year 1976, but has dropped to about $14 million in fiscal year 1982, with further reductions proposed by the President in fiscal year 1983. The Weather Modification Advisory Board, in its 1978 report commissioned by the Secretary of Commerce pursuant to the 1976 Act, recommended a 20-year consolidated Federal weather modification research effort reaching expenditures of $37 million by fiscal year 1980 and $89 million by fiscal year 1984. Recent budgetary constraints have prevented even modest spending increases in current research programs, and an attitude of "wait and see" what weather modification can do has dampened congressional interest in promoting a vigorous weather modification research effort in recent years.

Analysis

With increased demand for water resources and concern for reducing losses from severe weather, there will be expanded weather modification activities by States, local jurisdictions, and private interests. Development of technologies that are effective and socially acceptable should be a major goal of any Federal

weather modification policy and research program. A sound Federal program which seeks understanding of fundamental atmospheric processes as well as improvements in applied technology could provide assistance to States and other entities on best weather modification practices and assist them in evaluating results of operational programs. A Federal weather modification office, established under such a program, could also establish regulations and address issues relating to permitting of projects and licensing of operators, social and economic problems and benefits, interstate disputes over ownership of atmospheric water resources, and international weather modification activities.

Inasmuch as a number of bills establishing a Federal weather modification policy and program have appeared before Congress in recent years, it is reasonable to expect that such legislation will also be proposed during the 98th Congress. Hearings on these bills should provide opportunity for the Congress to learn about the most recent research findings and the effectiveness of current technology as well as current legal, social, and economic issues related to weather modification activities. Such information, along with findings and recommendations of recent studies, should provide a basis on which Congress can evaluate the need for enacting legislation establishing a Federal weather modification program during the 98th Congress.

CARBON DIOXIDE AND CLIMATE

Issue

A persistent concern is the increasing concentration of carbon dioxide (CO_2) in the atmosphere from continuing and expanding use of fossil fuels. Increased CO_2 may warm the Earth's climate, change precipitation regimes, and alter oceanic circulation patterns. However, the atmospheric changes may remain unmeasurable until at least the turn of the century, and the effects, if any, may not be of substantial magnitude until well into the next century.

Background

Since 1850, human activities have increased the amount of carbon dioxide in the Earth's atmosphere by about 16 percent, from an estimated 290 parts per million, or less, to some 338 parts per million average atmospheric concentration. Perhaps a fourth of the total increase has come within the past decade. Currently the worldwide increase is approximately 0.3 percent per year, and at current rates of fossil fuel consumption, approximately 5 to 6 gigatons of carbon (as CO_2) per year are released to the atmosphere. About half of the total amount of CO_2 released from fossil fuels remains in the atmosphere, resulting in the observed increasing concentrations. It has been assumed that the world ocean and both the land and marine biospheres serve as sinks for the remaining half of this excess carbon dioxide, but the fate of this missing 50 percent is still a matter of debate. For instance, some investigators have evidence that an appreciable net transfer of carbon dioxide to the atmosphere may result from such terrestrial biospheric changes as clearing of forests. Conversely, other investigators have concluded that there is no compelling evidence which establishes that the terrestrial biomass has decreased at a rate comparable to that of fossil fuel combustion, and, furthermore, that the regrowth of previously cut forests and the enhancement of forest growth resulting from CO_2 enrichment of the atmosphere must certainly have compensated for the forest destruction during the past few decades. Estimates of the flux of carbon from the atmosphere to the world ocean also vary widely. As a consequence, confident predictions of future atmospheric concentrations of CO_2 are difficult to generate at present, even if the future rate of combustion of fossil fuels were known with some certainty. A better understanding of the roles of both the biosphere and the world ocean in the carbon cycle would seem a necessary prerequisite. Until such time, estimates of future increases of atmospheric carbon concentration are approximations at best.

Analysis

The "carbon dioxide question" is actually several questions: How much CO_2 will be added to the atmosphere in future years, and at what rate, from the burning of fossil fuels and the clearing of forests (a function of world population, economic activity, the costs and availability of energy sources, and technologies for utilizing energy)? Will the increase in CO_2 cause a significant global rise in average temperature; or might some currently known or some as yet unknown countervailing climatic factor or feedback effect moderate the warming? What would be the consequences of such climatic warming for the natural environment? To what extent would the CO_2-induced warming trigger changes in the climate of various regions, in the land and oceanic biospheres, in sea level, and the extent

of ice and snow in the polar regions? How and where would such warming benefit or disrupt present patterns of agriculture? Would the possible spectrum of climatic changes and other effects portend major consequences for human societies, and if so, what would be the exact nature and balance of beneficial and harmful effects for the economic, political, and social systems of nations? Where might they occur?

Confidence in the carbon dioxide hypothesis will be much firmer if a warming trend exceeding the "noise level" of annual fluctuations in temperature becomes evident. Almost any reasonable estimate of how much fossil fuel will be burned in the coming years suggests that if carbon dioxide is indeed altering climate, an unmistakable warming trend should manifest itself in the 1990s. To what degree the trend and subsequent patterns of change would by then be reversible is an open question.

In sum, the CO2 question is seemingly obscured by many unknowns and uncertainties. The CO2 problem does pose a classical dilemma: To respond now to a threat with still-uncertain scope and timing might require unnecessary commitments of resources. But to postpone action until climatic change is detected entails the risk of being unable to prevent further changes that could prove irreversible on the order of centuries.

DESALINATION RESEARCH AND DEVELOPMENT

Issue

The Federal Government has been involved in desalination research and development for nearly 30 years. The Reagan Administration has announced its intention to abolish the Office of Water Research and Technology in the Department of the Interior where the desalination research and development program has been located. A review of the accomplishments of the Federal desalination program and the current status of desalination research would address the question of further need for Federal support in this area.

Background

Approximately $320 million has been spent on the Saline Water Program by the Federal Government since passage of the Saline Water Act (66 Stat. 328) in 1952. According to a survey in 1977, there were 481 desalting plants with a capability of 25,000 gallons per day or larger operating in the United States with a combined capacity of a little over 100 million gallons per day. Eighteen of these plants had an individual capacity of over one million gallons per day. Forty-two U.S. firms have engaged in the manufacture of desalting plants.

Currently, the United States withdraws fresh water at the rate of approximately 360 billion gallons per day, of which about one-third is consumed and the rest returned, often degraded in quality. Water supply and quality problems are severe in 14 of 106 subregions of the United States and it is expected that the number of severely impacted subregions will increase to 24 by the year 2000. Desalination is one means of supplementing fresh water supplies and improving the quality of impaired water. In the United States, the demand for desalted water is estimated as high as 29 billion gallons per day by the year 2000, depending on price and available alternatives.

Analysis

Congress may wish to review the status of desalination research and development to determine whether or not the Federal program has stimulated sufficient private investment in research and development in this area. What are the most productive areas for further research? Can the private sector meet future needs in desalination research and development with termination of the Federal program? What challenging new areas might be investigated, such as coupling a desalting plant with an open cycle OTEC process, or conversely, what aspects of desalination research, such as surface condensers, might have application to OTEC? What long-term impact will termination of the desalination program have on the competitive position of U.S. firms in the international desalination technology market?